

UNIVERSITY OF ILLINOIS
LIBRARY

Class

Book

Volume

C

P93uJ 2-4

The person charging this material is responsible for its return to the library from which it was withdrawn on or before the **Latest Date** stamped below.

Theft, mutilation, and underlining of books are reasons for disciplinary action and may result in dismissal from the University.

To renew call Telephone Center, 333-8400

UNIVERSITY OF ILLINOIS LIBRARY AT URBANA-CHAMPAIGN

APR 26 1980

SEP 04 1986

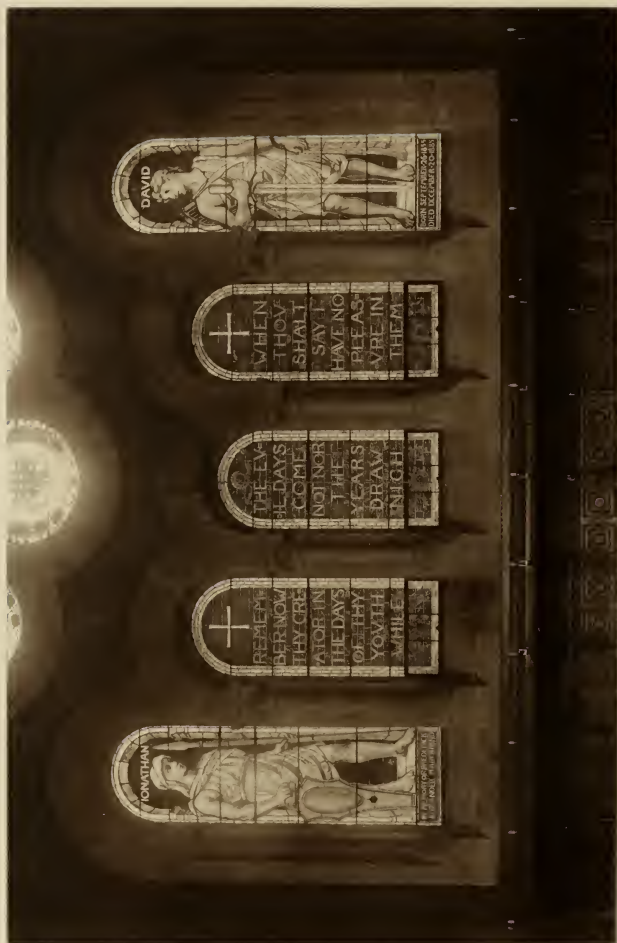
S-4-11

L161—O-1096



Digitized by the Internet Archive
in 2013

<http://archive.org/details/princetonunivers2418asdf>



MEMORIAL WINDOWS IN MARQUAND CHAPEL.

BY FRANCIS LATHROP.

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. II.

JANUARY, 1889.

No. 1.

PUBLISHERS' NOTICES.

With this number the BULLETIN enters upon its second year. In connection therewith the attention of its readers is called to the change made in the advertising pages, which are to be confined hereafter almost exclusively to publishers' notices. These will be set up newly in large part for each issue in order to furnish timely notice of the latest publications. By thus bringing the advertising sheets strictly into keeping with the other contents, the editors expect to increase the usefulness of the BULLETIN to its readers.

ON COLLEGE STUDENTS WHO ARE NOT CANDIDATES FOR A DEGREE.

By ALLAN MARQUAND,
PROFESSOR OF THE HISTORY OF ART.

Our American Colleges are in general established upon the model of a four-years' course of study, more or less prescribed, leading to the first or Bachelor's degree. But, almost without exception, we admit to our numbers students who are not candidates for a degree. This is found to be the practice of our Law Schools and Medical Schools, as well as in the Scientific and Academic departments of our Colleges. On the one hand these students are looked down upon as if they had no share in our intellectual aristocracy—on the other they are honored as a class from which have frequently arisen most proficient scholars. These differing points of view are illustrated in the poli-

cies of two of our oldest colleges. At Yale College such students are excluded altogether. President Dwight writes: "We have never had such special Academic students and have never been disposed to have them." And again: "I think the special and short course men demoralize the others more than they benefit themselves—the College that keeps to the regular and full course will accomplish the best work." In these words there is no uncertain sound. Special students are regarded as an evil, and against them the College doors are closed.

At Harvard College special students have been admitted for nearly a century. President Eliot writes of them in 1881 (Report 1880-81, p. 18): "The category naturally includes a considerable variety of persons; but the great majority of the students who have belonged to it have been desirable members of the University, and some of them have been young men of unusual power and merit. Increase in the number of these special students will not only add directly to the influence and usefulness of the University as a teaching body, but will also have an indirect effect of perhaps equal value. If all competent young men can freely pursue here the studies of their choice on equal terms with any other students, the University does not refuse to give instruction when it maintains rigid requisitions for its degrees; it only denies these traditional testimonials to persons who do not fulfil all the prescribed conditions."

It is not without interest therefore that we inquire into the Academic status of these undergraduates.

If we refer to the catalogues of various Colleges we find such students admitted under various names. They are called *Specials* at Harvard, and by this designation they are most frequently known. They were so named, doubtless, because at first they formed a special class by themselves, distinguished from the great body of undergraduates by the pursuit of other studies or of a special modification of the regular course, which rendered them ineligible to the Bachelor's degree. It is interesting to notice that they were first admitted to Harvard College in 1825 in response to the demand felt for a scientific as distinguished from a classical education, and that after the establishment of the Scientific School in 1847 all the members of the school were designated as "Special Students" in the annual catalogue, and that no degrees were offered in that school until 1851. So rapid, however, has been the development of scientific education in this country since 1850, that the Massachusetts Institute of Technology can now offer the B. S. degree for the successful accomplishment of any one of ten different curricula of four years each. Several of our institutions have developed their scientific courses to nearly this extent.

If we look beyond the border line of the country to Dalhousie College, at Halifax, we find the same body of students designated as *General Students*, doubtless so named because they do not follow the special curriculum prescribed for a degree; if we look to the South, they are called *Optional* students at the University of North Carolina, *Elective* students at South Carolina, and *Irregulars* at Texas. At Brown University they are known as *Select* course students; at Williams and the University of Pennsylvania as *Partial*

course students; at Union as *Eclectic* course students, and at Bryn Mawr the junior students of this class are designated as *Specials*, while those who have reached twenty-five years of age are known as *Hearers*.

This diversity in the names which are applied to this body of students is a significant fact, since the Colleges which give the B. A. degree are almost unanimous in naming as Freshmen, Sophomores, Juniors and Seniors, the successive classes of regular students. In the University of Michigan we find the undergraduates broadly classified as Candidates for a degree, and Students not candidates for a degree, and in the Johns Hopkins University these two classes are further subdivided, the first into Matriculates and Candidates for Matriculation, the other into *Specials* and Preliminary Medicals. But this subdivision of classes is exceptional.

This diversity of names is but one indication of the real diversity in the character of the students who are found in this class. Into what class would we put an elderly gentleman who wished to supply the deficiencies of a neglected youth? If not a graduate, he would be classed as a special. Into what class do the faculties place men of poor health, or of imperfect preparation, or of tastes too strong in particular directions to permit of their successfully following the set courses which lead to a degree? These also are classed as specials. What is the class to which undergraduates are looking with ever increasing interest for giants at foot-ball, base-ball, and athletic games? This is frequently also the class of special students. Into what class would a student go who could not afford to spend four years at college, but who wished a briefer period of training preliminary to a professional career? If admitted at all, at most of our colleges he too would be classed as a special.

It is evident, therefore, that the age, attainments and aims of special students vary so widely as to make it important that the heterogeneous class of specials should be subdivided. Some, but not many, of our institutions have attempted such a classification, and by so doing they not only obviate some trying difficulties in collegiate discipline, but go farther to meet the educational demands of the country, which it is the privilege of our colleges to supply.

In the absence of anything like uniformity of practice in this direction I venture to propose a system of classification which combines important elements already existing in various institutions. Taking into account the differing aims of undergraduate students who are not candidates for a degree, they fall into three classes: 1) General students.

2) Special students.

3) Short Course students.

1. *General Students.* This division now constitutes the majority of the class under consideration. They are men who wish a general education, but by reason of defective preparation or some misfortune are unable to matriculate without conditions; or having matriculated, are unable to follow successfully the defined curriculum. This inability is not always culpable, and in many instances such students have made up their deficiencies and passed with credit into the regular classes. In his report for 1887-88 President Eliot gives the statistics for the six academic years from 1882-88, in which it appears that 84 specials during that period had been transferred to the regular classes:

1882-83	10
1883-84	9
1884-85	6
1885-86	14
1886-87	15
1887-88	30
—	—
	84

And every college which has dealt carefully with this class of students, has had more or less of this experience.

General students should be subject to some such regulations as these. They should be not younger than the candidates for a degree, should pass examinations preliminary to the courses they intend to pursue, should fill out a schedule for the same number of hours as regular students, should be credited with examinations passed, and receive every encouragement to become candidates for a degree. Scholarships and prizes should be open to them on almost the same terms as to regular students, and certificates and final honors given them for high grade of scholarship. As this class of students will stand in need of special guidance in the arrangement of their studies, they should be placed under advisors or under a special committee from the faculty.

II. *Special students.* This class consists of maturer students—usually such as have attained their majority—whose purpose is to pursue some special line of study or a few related branches. Such special study may be designed to fill a gap in their previous training or be directly related to their vocation in life. This class will consist usually of serious-minded men with a definite purpose. That purpose should be stated to the proper authorities and the subjects they intend to pursue be duly registered. No such regulations will be necessary as are indicated for the previous class. Scholarships, if offered to this class of students, should be given only in cases of extraordinary talent.

III. *Short Course Students.* There are many students in our schools of Law, Theology and Medicine who are not college graduates, because they could not afford the time required to complete a full college course. Such students are now forced to enter the professional schools with an ill-regulated preparation. Several

of our colleges have established a two-years' course preliminary to the study of medicine. Why may not this practice be extended and two-years' courses arranged for special students directly preliminary to the work of the Law School and Theological School, and also to the pursuit of Literature and Journalism, to the career of a Teacher and to Commercial Life? Such courses would involve little more than the mere organization of what is already given in our colleges, and would materially assist and encourage a worthy class of students. It need not be feared that such courses would draw away students who would be applicants for degrees; they will rather attract students who otherwise would not come to college at all. Between the regular college graduate who has worked three or four years for his Bachelor's degree and the preliminary medical or theological student who remains but two years and receives no degree, there will always be sufficient distinction in favor of the former. The liberty in the selection of his studies is now so great for the regular student during the last two years of his course that he also may pursue such studies as are directly preliminary to his profession without losing his Bachelor's degree. The introduction of such courses therefore will only add new lustre to the college degree and at the same time be a direct benefit to our professional schools.

Having indicated that mode of classification which, we believe, would materially benefit the cause of special students, we proceed to inquire into the status which such students actually hold in our colleges.

I. What is the proportion of specials to regular students?

During the last academic year there were:

Yale College.	SPECIALS.	REGULARS.
Academic,	0	688
Scientific,	8	300
Princeton.		
Academic,	41	422
Scientific,	19	92
Harvard.		
Academic,	145	1035
Scientific,	29	6
Columbia,	38	227
Cornell,	178	788
University of Michigan, . .	130	629
University of Pennsylvania, .	76	251
University of California, . .	106	241
Johns Hopkins,	41	85

That is to say at Yale, special students are as rare as 1 in 100; at Princeton they are common as 1 in 8; at Harvard and Columbia as 1 in 7; at Cornell and Michigan as 1 in 5; at University of Pennsylvania as 1 in 4, and at the University of California and at the Johns Hopkins as 1 in 2.

An average of twenty-five colleges in the Middle States shows the special students amount to one-sixth of the whole number.

From the scale we have given with Yale College at one extreme and the Johns Hopkins at the other, we can see that the actual numerical ratio of students in these institutions who are working without reference to a degree is no small quantity. We conclude then, the number of such students who are ready to be admitted to our colleges is sufficiently great to make the problem of their education of considerable importance.

II. We need further to inquire into the quality of special students. What are they accomplishing in our colleges? May it be said of them in the strong language of President Dwight that they are demoralizing the others more than they benefit themselves? Such indeed may be the case when the attention of educators is not

directed to their improvement, but the very reverse appears to be true when the work of special students is properly regulated; and their accomplishment is greater than is usually supposed. We extract the following from President Eliot's Report for 1883-84, p. 29:

"On comparing the scholarship of the fifty-two special students who made a record in 1883-84 with the scholarship of the Freshman class in the same year as exhibited in the annual rank-list, it appears that of the

Special Students	8 %	earned an average mark of	90 % or over.
Freshmen	5 "	"	" " "
Special Students	17 "	"	80 " "
Freshmen	16½ "	"	" " "
Special Students	27 "	"	70 " "
Freshmen	37 "	"	" " "
Special Students	63 "	"	50 " "
Freshmen	77 "	"	" " "

That is, there was a larger percentage of very good scholars among the special students than among the Freshmen in 1883-84 and a smaller percentage of fair and passable scholars. They had the great advantage over the Freshmen of choosing their studies."

A similar estimate of the quality of special students of the Scientific School at Princeton shows a similar result. In the following table the status of the Specials is compared with that of the three classes, Freshmen, Sophomores and Juniors, taken collectively.

Regular Students:

Grade from	NO.	PROPORTION.
90-100,	4	.07
" " 80- 90,	17	.30
" " 70- 80,	19	.34
" " 60- 70,	9	.16
" " 50- 60,	7	.13
	56	1.00

Specials:

Grade from	NO.	PROPORTION.
90-100,	3	.18
" " 80- 90,	2	.12
" " 70- 80,	4	.23
" " 60- 70,	7	.41
" " 50- 60,	1	.06
	28	1.00

From this it will be seen that the proportion of high-stand men, graded from

90 to 100, is larger among the special, and the proportion of low-stand men, i. e. 50 to 60, correspondingly smaller; but that the average standing of the regular student is somewhat higher. The actual status of the special student is doubtless a little higher than these figures indicate, as there is a natural presumption in favor of the regular student receiving a higher grade.

In the Academic departments at Princeton, it is very difficult to compare the standing of special with that of regular students, as they are not ranked in accordance with the same system. But it is safe to affirm that the average standing of special students is below that of the regulars.

This is perhaps the experience of many institutions, namely that though a small number of special students may distinguish themselves, nevertheless the class as a class is a drag upon the improvement of the regular students.

What then shall we do? Shall we take the heroic measures of Yale College and rid ourselves of the whole class of special, good and bad alike, or shall we not rather, in the spirit of Harvard, direct our efforts to their improvement?

We have already indicated some of the ways by which the condition of these students may be improved. They should be classified according to the objects which they have in view; their status should be assimilated as far as possible both in discipline and in privileges to that of the regular student and every encouragement should be offered them to improve their own condition. Of all the efforts which have been made for this class of students at Harvard, the most effective has been the institution of a committee of the faculty whose function it is to supervise them. This committee began their good work in 1886, by ridding the College of the drones and directing more carefully

the energies of the workers. Since this careful supervision both the President and Dean in their reports testify to the sensible improvement which has resulted in the quality of special students at Harvard.

A similar Committee on Specials has been organized at Princeton and have begun their work of supervision in a thorough manner. It may be confidently expected that we shall meet with similarly encouraging results.

In conclusion it may be said that whenever a definite curriculum is arranged and entrance examinations are required, sooner or later the demand will be felt for admission by students who for one reason or another need a slightly different form of education from that which is supplied. The practice of admitting special students to our colleges is now so universal that no argument in its defence is necessary. Even at Yale we see them admitted to the Law School and to the Scientific School and the time will doubtless come when the fence which excludes them from the Academic grounds will also be taken down. But while we do not need to defend ourselves for this wider extension of the facilities of education, we may need to condemn ourselves, if, having admitted special students to our classes, we have treated them with neglect.

Let us not put barriers in their way, but so adjust our college organism as to facilitate their progress. Let us organize them, care for them, improve their intellectual quality. If we fail to do this, they will certainly "demoralize the others more than they benefit themselves."

Read before the College Association of the Middle States and Maryland, Philadelphia, November 29th, 1889.

THE CATHOLIC UNIVERSITY IN WASHINGTON.

The opening of the Catholic University in Washington this autumn, at the time

of the Catholic Congress in Baltimore, is an event of so much significance as to call for a few words in regard to its scope, its present condition, and its probable future. The history of its foundation, of Miss Caldwell's generous endowment, of the popular subscription among Catholics throughout the country, is well known. This preliminary fund was sufficient for the purchase of sixty-nine acres of land, the erection of a large building for the Theological Faculty, and the endowment of its professorships.

The site is three miles from the city, in a commanding position. Enough land has been secured for any future requirements of the institution. The building erected is a large and solid stone structure, four stories high with two wings, which will doubtless remain the central structure of the campus. It is well arranged, light and airy, and combines the features of a hall and dormitory. The class-rooms, library, refectory, and reception rooms are on the lower story; the living rooms occupy the other three, and at the top of the building is a general social room combining the elements of a reading room, gymnasium, and billiard room. In the class-room each student is provided not only with a seat but with a desk; and, above, each man has a study attached to his bedroom. A working theological library has been begun and already contains about six thousand volumes.

The University is strictly for graduate work and will have no undergraduate department connected with it. The Catholic colleges over the entire country are expected to be its feeders. The 49 students who have entered the Divinity School alone during its first year give good promise for its future. The entrance requirements are: a thorough classical training, usually of six years, a two-years course in philosophy, and one of four years in theology.

The rector, Bishop Keane, is well known as one of the ablest and most enlightened Catholic prelates in the country. The following professors are at present teaching, each one a distinguished specialist. Dr. Joseph Schröder, of Cologne, has the chair of Dogmatic Theology. Dr. Thomas Bouquillon, of Liège, formerly of the University of Lille, teaches Moral Theology. Christian Apologetics or Fundamental Theology are in the hands of Dr. Joseph Pohle, of Fulda, one of the foremost theologians of Germany. The professor of Scriptural Archæology and Oriental Languages is Dr. Hyvernat, a young Orientalist, who is making himself well known as a scholar and traveller. The Rev. A. F. Hewit lectures on Ecclesiastical History and is assisted by Dr. Chapel. The Rev. Geo. M. Searle, formerly assistant astronomer at Harvard, lectures on Mathematics and Astronomy. The well-known writer, C. W. Stoddard, is lecturer on English Literature, and the Rector himself, Bishop Keane, has charge of classes in Sacred Eloquence.

Beside these teachers there are others, already appointed to chairs in this faculty, who are at present in Europe, on leave of absence, engaged in preparing for their duties. Dr. E. Pace, of Florida, is studying Experimental Psychology at Leipzig; Dr. T. J. Shahan, of Hartford, is in Berlin, perfecting himself in Historical studies; Dr. Charles Grannan is pursuing Scriptural studies in Paris; and Dr. Sebastian Mesmer, formerly of Seton Hall College, is working on Canon Law in Rome.

It is hoped by those in charge of the Catholic University that in about two years a second department will be established—that of Philosophy and Letters. This will be conceived on about as broad a basis as the corresponding department in Germany, and will not only provide a finishing education in general scholarship,

but will lay the foundation for special work in the faculties of Law, Medicine, and Science, which will be successively founded. It is the policy to completely establish, with buildings and endowed professorships, each department, before the next is begun. The fact that the institution is denominational will not in the least interfere, in Bishop Keane's opinion, with the breadth and thoroughness of its scholarship. It is the intention that every branch of Science shall be thoroughly taught.

The immense resources of the Catholic Church and her power of organization leave no doubt this University will slowly become a completed whole with all its faculties, and be a great power in the land. It cannot fail to raise the standard of learning among the American Catholic clergy, and to lead into the paths of knowledge a large number of the Catholic laity.

*THE NEW CLARK UNIVERSITY AT
WORCESTER.*

Clark University and the Catholic University appear to represent the opposite poles in the development of higher education in America. The former shows its bias for the natural sciences by making its *début* with only a scientific faculty just as strongly as the Catholic institution does its bias for religion by founding a Divinity School as the germ from which it is to develop. The ideal of an education in which religion forms a constituent part is opposed by that of an education which does not consider religion as a suitable educational theme.

The University at Worcester is earning its spurs this winter, having opened its doors on October 2d, 1889. The history of its foundation can be told in a few words. Three years ago Mr. Jonas G. Clark of Worcester announced his intention of establishing a university in that

city. This decision was taken after he had spent eight years in the study of European universities. The corner-stone of the first and central building was laid October 22, 1887, in an eight-acre lot. It is a plain edifice of brick and granite, four stories in height. Its internal arrangements are both luxurious and commodious. The second building, already completed, is a chemical laboratory containing about fifty rooms; and a third edifice is in process of construction.

In the spring of 1888 Dr. G. Stanley Hall, then professor of psychology and pedagogics at the Johns Hopkins University, formerly of Harvard University, was chosen as president of the new institution. He then went to Europe for a year and studied its educational establishments from Great Britain to Austria and from Norway and Sweden to Italy.

The following general features of the plan should be noticed: (1) that the instruction is post-graduate, no undergraduate department being attached to the University; (2) that the right of the elective system which has been restricted to men within a single institution is asserted for institutions as well; (3) that a feature, new to America, but adapted from Germany, has been introduced, called the Docent system. These points need amplification. The following classes of students are admitted:

(a) *Independent Students*, furnished with Doctor's or other degrees, some of which may be appointed docents; (b) *Candidates for the Degree of Doctor of Philosophy*, whose full course is one of three years, reduced to two in special instances, and for whom the fellowships and scholarships are especially provided; (c) *Special Students not Candidates for a Degree*, who without wishing to perfect themselves in a general course, are well advanced in the special branches they elect to study; (d) *Medical Students* for whom facilities are offered in

the fundamental disciplines upon which the study of medicine rests; (e) *Preliminary Candidates or Undergraduates* who have completed the work of the first three or at least of the first two years of a regular undergraduate course and are candidates for an A. B. and a higher degree.

The annual tuition fees are fixed at \$200, not including laboratory fees, but a large number of students are exempted and assisted in the following manner. Mr. and Mrs. Clark give full tuition (\$200) for thirty meritorious students every year. Eight of these also receive a fellowship yielding \$400, and eight more receive fellowships of \$200 per annum. The department of psychology has besides two fellowships of \$400 and two of \$200. A further attraction is offered to the class of advanced, independent students, men who are training and perfecting themselves for the position of teachers. On a certain number of these every year the title of *docent* is conferred; that is, they receive the *venia docendi*, or right to teach, in the same manner as the privat-docenten of German Universities. Special rooms furnished with the necessary apparatus and other facilities for their work are placed at their disposal and they also receive a small salary. From this class it is expected that the future appointments to professorships at Clark University will be made, to it, also other institutions will first look for accessions to their faculties, as to the group of men most advanced in their knowledge yet candidates for a position.

The branches taught this year are five. Mathematics, Physics, Chemistry, Biology and Psychology. In explanation of this fact and of the manner in which the idea of a university is understood at Worcester, a few words may be quoted from President Hall's opening address. "A word so characteristic here that it might stand upon our very seal, is concentration. . . . We have selected a small but related group of

five departments, and shall at first focus all our means and care, to make these five the best possible. Neither the historical origin nor the term university have anything to do with completeness of the field of knowledge. The word originally designated simply a corporation with peculiar privileges and peculiarly independent to do what it chose. We choose to assert the same privilege of election for ourselves that other institutions allow their students, and offer the latter in choosing their subjects a larger option between institutions." Two interesting points are here presented. Firstly, it is claimed that an institution will be no less a university because it does not include all the faculties, and that even if, for example, Clark University may never have a theological or a law faculty it will be none the less a true university. Secondly, encouragement is given to advanced students to follow a European custom which, for that matter, was practised even among the Mediæval Arabs; this was the habit of inter-university migration, for the study at each institution of that subject which was taught by the most famous specialist of his time.

A few words should be said in regard to the men that have been appointed on the faculty, they are so well known as specialists of marked ability that it will be sufficient to give their names.

President—G. Stanley Hall, Psychology.
Full Prof's—Arthur Michael, Chemistry.

A. A. Michelson, Physics.

W. E. Story, Mathematics.

C. O. Whitman, Biology.

Ass. Prof's—Oskar Bolza, Mathematics.

H. H. Donaldson, Neurology.

W. P. Lombard, Physiology.

F. P. Mall, Biology.

John A. Nef, Chemistry.

E. C. Sanford, Psychology.

Of these men Messrs. Story, Donaldson, Lombard, Mall and Sanford came from the Johns Hopkins University. Besides

these regular members of the faculty nine docents were appointed for the year and thirty-three fellows and scholars; no estimate of pay students has been given to the public, but, owing to the large amount of the fee it can hardly fail to be small.

Clark University is therefore essentially a training school for teachers and experts; an association professedly for the advancement of science by original research and the diffusion of higher standards of knowledge both theoretical and practical. Whether or not it be an agent for good, will depend on its management and governing ideas. Its stability will not be assured in the minds of careful observers until its permanent endowment is secured instead of its being dependent, as we are informed upon the footing of individual bills by its generous founder. Instances are known of similar cases in which through the absence of a will or a deed of gift an institution similarly founded has died a premature death.

ORGANIZATION OF UNIVERSITY AND SCHOOL EXTENSION.

In the first issue of the BULLETIN (I. 1) attention was called to two schemes that were then being organized for the purpose of diffusing the benefits of education among the many whose means or occupations do not allow of their frequenting an institution of learning. To the plan of the first of these, organized under the patronage of Columbia, Harvard, Princeton and Yale, attention may well be called again in view of two recent meetings in New York, held on December 7th, and Feb. 1st.

Up to the present no definite organization had been effected and no definition had been reached of the methods to be followed in carrying out the general ideas involved in the plan. It was thought that the best way to effect this would be to hold during the winter three meetings

to which all the teachers of public schools, colleges and universities in this section of the country should be invited. At these meetings ample opportunity would be given for the presentation and discussion of different views by the ablest educators.

The subject of the first meeting was the relation of the colleges (or universities) and the schools to each other; how each could benefit the other; how a collaboration could be established for the diffusion of a better standard of teaching and learning. Over two hundred men took part in this meeting, all being educators. Princeton was represented by Professors Frothingham, Libbey, Marquand, Shields and Willson. President Seth Low of Columbia was the presiding officer, and the principal speaker of the evening was President Eliot of Harvard. Cornell, Yale, the College and University of the City of New York were represented as well as Columbia, Harvard and Princeton. But the bulk of the men belonged to the Public schools of New York City and State, Brooklyn, Jersey City, Hoboken, Newark, New Brunswick, Orange, Trenton, Albany, etc. This is said to have been the greatest gathering of the kind, held in this country.

President Low spoke of the added strength that would be given to schools and universities by the extension of their influence and warned against a belief that in America it would be possible or well to carry out the same plan of extension adopted so successfully in Great Britain by Oxford and Cambridge and in London. President Eliot regretted the separation in our country of the different educational agents—the schools and universities,—in contrast to the unity of the educational system in European countries. He doubted whether the English system could be carried out in our country as we had no body of salaried learned men of leisure devoted to the practise of teaching such as is formed by the fellows of the English uni-

versities. Harvard University has already accomplished much in the way of "articulating" with the schools of Massachusetts (1) through the use of university graduates of the best quality in superintending special branches of instruction in the public school system, and (2) through the establishment of both summer and winter courses for the instruction of public school teachers in the advanced work of their special departments. Such classes are given in English, in Physics, in Geography and Chemistry. The establishment of the winter courses in the city of Boston was made possible by the generosity of some gentlemen who furnished the funds necessary to secure, at a very moderate rate of compensation, the services of Harvard professors. The result has been a great improvement in methods of teaching in the public schools, for "it is a recognized fact that only needs mention, that the best methods of teaching, in any national system of education, come from above—from the Universities and Colleges."

The necessity for radical improvement in the Public School system was shown in forcible language by President James C. Hendrix of the Brooklyn Board of Education who pointed out with unsparing hands, its defects and their consequences.

The second meeting was held on February 1st; the question discussed being what the Universities can do for the people. It was presided over by President Dwight of Yale and the principal speaker was Prof. Win. T. Harris, the well-known educationalist and philosopher, also U. S. Commissioner of Education. President Gates of Rutgers, was one of the speakers.

*THE COLLEGE ASSOCIATION OF THE
MIDDLE STATES AND MARYLAND.*

The rapid growth and internal development of our colleges has made it necessary that the entire scheme of collegiate

education should receive a thorough reconsideration. The college must be so organized as to articulate more thoroughly into the universities and professional schools on the one side and into the preparatory schools on the other. Courses of study must be so re-adjusted, systems of discipline re-modelled, and the conditions for admission, graduation and for the various degrees re-determined. The fact that many of our colleges are now considering these very problems makes an association for the purpose of discussion unusually helpful and important. Three years ago the colleges of Pennsylvania organized a College Association and held their second annual convention in Philadelphia, July 5th, 1888. At this meeting the association re-organized as the College Association of the Middle States and Maryland and held its first annual convention at the University of Pennsylvania, November 29th and 30th, 1889. At this meeting there were present representatives of Columbia, Cornell, Johns Hopkins, Princeton, Rutgers, St. John's, Union, and the University of the City of New York, in addition to those of a dozen colleges in Pennsylvania already members of the Association.

The work of the convention was divided between conferences and the reading of papers. On the first day the subject for conference was "The Sphere for Technical Teaching in the University Curriculum," the principal speakers being President C. K. Adams, of Cornell University, and President Isaac Sharpless, of Haverford College. Papers were then read by Prof. F. A. March, of Lafayette, on "The Study of English Required for Admission to College," and by Prof. Allan Marquand, of Princeton, on "Students who are not Candidates for a Degree" (printed above). Pedagogical papers were read in the afternoon by President MacCracken, of the University of the City of New York, James McAllister, Superintendent of Phila-

delphia Public Schools, Prof. Nicholas Murray Butler, of Columbia and by Prof. William A. Lamberton, of the University of Pennsylvania. A reception was given in the evening at which addresses were made by President William Pepper, President-elect Seth Low, and by ex-President White of Cornell. On the second day the conference was occupied with "The Significance of the Bachelor of Arts Degree." This gave rise to considerable discussion in which Prof. Edward J. Griffin, of the Johns Hopkins University, and President Merrill E. Gates, of Rutgers College, took leading parts. Then followed papers by Prof. Henry F. Osborn, of Princeton, on "The Fellowship System in American Colleges," and by Prof. Monroe Smith, of Columbia, on "The Philosophical Faculty in the United States." In the afternoon Prof. H. S. White, of Cornell, read a paper on "The Admission of Students to the University on Certificates," Prof. T. Rendell Harris, of Haverford, on "Examinations," Prof. E. J. James, of the University of Pennsylvania, on "The German Universities of to-day," and President Edward H. Magill, of Swarthmore, on "The Professional Education of Teachers."

As the work of these papers represented in some instances the results of careful inquiry, and in others gave valuable light from local experience, the published proceedings of the Association bid fair to be of considerable educational importance.

Princeton is doing her share in the Association. President Patton is the Vice-President to represent the colleges of New Jersey, Dean Murray is a member of the committee to consider the requirements in English for admission, Prof. West is on the committee on classical requirements for graduation, and Prof. Marquand is chairman of the executive committee.

We are happy to announce that the next annual convention will be held in Princeton.

THE NEEDS OF OUR LIBRARY.

If one as wise as Cicero were to be asked what is the first essential to a University library he would answer Books, and the second? Books. And the third? Books. For it is as hopeless to make a little library suffice for a great university as it is to make a growing boy comfortable and graceful in last year's clothes.

Libraries may be divided into three classes. The first is the circulating library whose elementary and most familiar type is the Sunday School library. It consists of books selected with reference to their cheapness and the untrained and generally poor taste of its patrons, who, for the most part, read because of a certain mental inertia and to save themselves the trouble of thinking.

The second kind of library is the small college library; consisting of from six to twenty thousand volumes. It is composed in part of the libraries of deceased clergymen which have been contributed to the institution in bulk. To these are added the encyclopædias and books of reference of the edition before the last, and a miscellaneous assortment of all the most obvious books in the ordinary branches of science, literature and art. It is particularly rich in the "books that no gentleman's library should be without," and which, perhaps for that reason, are most often found on the tables of the second-hand dealers. The ideas of those who use it are generally bounded, not by the horizon of the subject they are considering, but by the literature which is accessible; and one who had a discriminating knowledge of bibliography might form a fairly good catalogue of certain departments of such a library, after listening to the commencement orations of the college which possessed it.

And thirdly there is the *Library*, a collection of books conditioned, not by the

vulgar tastes of untrained readers, nor by the force of circumstances and the bitter stress of the "*res angustæ domi*," but by a generous love of literature and an ardent desire to fully equip the students of truth. It is designed for men who read in order to know, who know in order to think and feel, and who find in thought and feeling ever growing motives to fresh reading.

The faculty of a university is composed of such men trying to train a body of graduates to share their tastes, labors and enthusiasms—and so the library of a university can only be based on the last model.

No one who knows the history of the last twenty years can fail to perceive that Princeton has changed. The sentiment which animated the speeches at the inauguration of President Patton only expressed the growth which all had felt under his predecessor. We are no longer the old-fashioned small American college, and we cannot go back to the outgrown past. "*Aut Universitas aut nihil!*" If we do not care to make that our motto, a part of it may become our epitaph.

And our library must be as high in its ideals and as broad in its scope, as the aims and the horizon of the institution of which it is to be the center.

A university is known by its voice, and the voices to which the world listens to-day are those of men who have added to the general culture which gives them power of expression, the special training in one branch which gives them something to express. In the liberal branches, no man can become or remain a specialist of the first rank, without access to a full collection of the books of his branch constantly enlarged to include the newest discussions. At the present American market rate for learning, it is impossible for most professors to depend for their necessary tools on their private libraries, unless, as is rarely the case, they believe in the

celibacy of the professorate. The conclusion is, that, if we want our professors to represent us amid the learned discussions of the world in a manner befitting a university, we must supply them with a university library. Compared with the average American college, Princeton is munificently equipped with books. But then Princeton does not desire to be compared with the average American college. When we compare the contents of our two libraries with the collection of books at the great centres of learning in this and other countries, we find that she is poorly equipped for the vigorous present and that larger future to which she is committed, and to which those who love her hope she may attain. She ought to have for the not distant future half a million of books. She needs for the *immediate present* at least a quarter of a million of books.

If there is any one to whom this estimate seems excessive, we commend to their attention the anecdote about the man who agreed to give five thousand dollars to enlarge a college library, but, on ascertaining that they had twelve thousand volumes and had not read all those yet, withdrew his subscription. In order to have enough books for any assembly of scholars one must always seem to have too many. There is a parsimony which is the worst kind of wastefulness, and an extravagance which is the noblest wisdom and the highest economy. Truth is a jealous mistress. She grants no favour to those who would count the cost of her service.

PRINCETON UNIVERSITY LECTURES.

The number and character of the public lectures given in Princeton during a season has been a very variable quantity. The present college year promises to be one of remarkable interest and variety in this respect. Those given up to the present have

all been connected with the department of Art and Archæology, which ever since its establishment has shown remarkable zeal and activity in bringing here such lecturers as Prof. Charles Waldstein, Mr. Russell Sturgis, Comm. Rodolfo Lanciani and Dr. Wm. C. Prime.

MR. LAWTON ON DELPHI.—On Dec. 6th, Mr. Wm. C. Lawton delivered a lecture on Delphi. He had recently been appointed agent of the Archæological Institute of America and sent on a mission for the purpose of forming branches of the Institute in the West and of adding to the fund that was being collected for the excavation of Delphi; in both of these undertaking his efforts had been successful, and on his return to the East he came here, to tell us about the aims of the Archæological Institute, the good work accomplished by its School at Athens (to whose support we contribute as a college), and the reasons why it is greatly to be desired that we secure for America the honor and glory of excavating Delphi, the greatest centre of religion and, excepting Athens, probably the greatest emporium of art in Greece.

The Archæological Institute has gained experience and earned success by its excavations of the past nine years at Assos, Sikyon, Ikaria, and other sites, and is now prepared to undertake the responsibility of this excavation at Delphi provided the necessary funds, variously estimated at from \$70,000 to \$100,000, can be raised. The priority belonged to the French, who first attempted work on this site many years ago, but they have failed to secure the funds for the purpose. The great expense is involved in the purchase of the modern village of Kastri, built on the ancient site.

MR. VAN DYKE ON PAINTING.—Mr. J. C. Van Dyke, Librarian of the Sage Library, New Brunswick, and author of *Principles of Art* (I. *Art in History*, II. *Art in Theory*), delivered a course of seven lectures On

Painting in the Old Chapel during November and December. It is very seldom that a Princeton audience has been privileged to listen to thoughts so well expressed, and clothed in so pictorial and delicately modulated a language. The lecturer possesses to a remarkable degree the power of calling up before the imagination, by the justness of his imagery and the delicacy of his verbal perception, the pictures he describes. The illusion was aided by a felicitous choice of examples and a lucid arrangement of the subject, so that each idea was illustrated before being abandoned and a close nexus was maintained throughout.

Mr. Van Dyke belongs to the modern school that proclaims the divorce of true art from religious, ethical, or historical ideas, and even from any ideas conveyed by other senses than that of sight. The only kind of ideas which he considers to be legitimately involved in painting are those pictorial ideas connected with the personal equation of the artist; the individuality of the artist impresses itself upon his interpretation of objects, and this is the only true kind of pictorial idealism. Following this system Mr. Van Dyke viewed the art of painting in these lectures purely from the standpoint of the craftsman. His theory was stated in his introductory lecture entitled *Art for Art's Sake*. In his mind there cannot be a greater and more fatal error than the common one of requiring ideas or ideals in art. A painting should be approved or condemned, admired or despised on account simply of its qualities of tone, color, value, perspective or composition. The lecturer thus concerned himself mainly with contemporary art from which this principle of judgment can be best illustrated. His sympathies are distinctly with the naturalistic school among the moderns as opposed both to the classicists and the romanticists.

After this introduction the different parts of the art of painting, viewed from the standpoint of "Art for art's sake," were treated in turn. The second lecture was on *Color, its differences and the manner of its use in modern art*. In it, after showing that color far transcended drawing in importance, the various methods of combining colors were explained. Until recently it was customary to contrast colors, the combination of complementary colors being more successful than that of primary colors and producing greater harmony. Among modern artists the law of contrast of colors has been superseded by that of variations of tone of a single color or similar colors. In his third lecture Mr. Van Dyke discussed *Tone, Light and Shade*, calling attention to the necessity of a tonal centre and of a subtle combination of high and low lights and shadows in order to secure harmony of effect; the two main laws of light and shade being proportion and relation. The subject of *Perspective* was treated in the fourth lecture, an historical sketch being given of its use since its probable first discovery by the Italian painters of the early Renaissance. Linear and aerial perspective were both described and thoroughly discussed. One of the best lectures was the next, on *Value or the relations of a picture*, in which a careful distinction was drawn between the characteristics of values as differing from those of color and tone, and the importance of this quality of true painting was insisted upon. The only illustrated lecture of the series was that on *Drawing and Composition*. A review was here given of the different claims of line and of color to be preëminent in painting. The classical school which is still ably represented in England and France finds the greatest beauty in line effects, while the majority of modern artists adhere more strictly to nature in emphasizing color over line. In the extreme wing of this school are the

impressionists for whom mere blotches of color are the *ne plus ultra* of beauty. In modern art the line represents repose and often lifelessness, while informed color embodies that vitality which should be the highest aim of the artist; it is this life-like quality that distinguishes the modern naturalistic school. In treating of composition its main laws were enumerated, the principal one being unity, and the artistic methods were described by which these laws were carried into effect: such were the arrangements according to the perpendicular, the horizontal, the broken, the curved, and the circular line. The closing topic was *Textures and brush work*. No summary could do justice to these lectures. It is with great pleasure that we hear they are also to be delivered at Columbia College and will then be published in book form in the Chautauqua series of handbooks.

MISS AMELIA B. EDWARDS.—Among the hundred and sixteen lectures delivered or to be delivered in the United States by Miss Edwards, two were given in Princeton, Dec. 8th and 9th, at the invitation of Professor Marquand. The audiences were remarkably large and appreciative of these unusually attractive lectures. Miss Edwards is both a master of literary expression and popular presentation, and an original investigator in the field of Egyptology which forms the topic of her lectures. She is therefore, as Dr. Patton gracefully said in introducing her, an ideal lecturer. The slides so profusely used to illustrate the text on both occasions were made for the most part from photographs taken by Mr. Petrie, the well-known explorer of Egypt, and were in nearly every case new even to specialists.

The first lecture treated of *The Origin of Portrait Sculpture in Ancient Egypt*. Beginning with the statement that all portraiture is in its origin funereal, Miss Edwards proceeded to show that the earliest portrait

statues are found in Egyptian tombs and were among the first products of Egyptian art. The reason for this unique early development was explained from the religious beliefs of the Egyptians. According to them the human being was composed of six parts: of these the body was mummified, the soul during its long period of probation wandered through the valley of death, the flame-like spirit flitted to and fro in ætherial regions, but the *Ka* dwelt with the mummy in the tomb. In the opinion of different authorities the *Ka* was the double of the deceased, or else his personality, but according to Miss Edwards it was the life, the vital principle. Therefore as it was sustained by food during its earthly existence it was inferred that it needed material nourishment also during the period of probation; hence the vast quantities of food provided at various intervals in the tombs, hence also the statues placed in walled-up recesses near the sepulchral chamber as bodies for the *Ka*. Each tomb had from three to seven of these statues. Both the statues as artificial bodies and the food as sustenance were necessary to ensure the existence of the *Ka* on which depended also the immortality of the deceased. In order that the *Ka* might feel at home in these bodies of wood or stone the artists sought to make them absolutely true to life, setting aside artistic pride and flattery. Whatever defect or peculiarity the individual might have was realistically reproduced. The result was the development under the Ancient Empire of a school of realistic portraiture that was never equalled in antiquity. Under the New Empire and the Ptolemies it declined and lost its vitality.

The second lecture had for its subject the development of painting in Egypt. The earliest examples belong to the Ancient Empire and are a combination of low relief and painting. In the lecturer's

opinion the art of painting preceded that of sculpture, but simple painting upon a flat surface is not found until the Middle Empire. A digression was made in order to throw light upon the relations of Egypt and Greece and it was demonstrated from the recent discoveries of Mr. Petrie that there were Greek settlements in Egypt in the time of the XIIth Dynasty, nearly fifteen hundred years before it was thought that any Greeks were established in the Nile valley. This discovery has been made in Lower Egypt at and near the site of the famous Labyrinth. On the pottery found here are incised letters in the Phœnician, Kypriote, Etruscan and so-called Kadmean Greek characters, thus carrying back the origin of this class of characters many hundred years before they had been supposed to have originated. Hence it is possible to date the earliest influence of Egypt upon the Greek races from this early period of c. 2300 B. C. At the close of the lecture Miss Edwards exhibited slides of some of the best of the famous painted portraits found lately in the Faiûm and dating from the early Roman period, representing Greeks and Romans, Egyptians, Nubians and Syrians and probably all executed by Greek artists. They are extremely realistic and form a new class of monuments of the greatest value for the study of ancient painting.

PEDAGOGICS IN AMERICAN UNIVERSITIES.

Politics and religion apart, there is scarcely any subject which has given rise to such conflicting opinions as the subject of education. In spite of this, it remains true, as Mr. John Stuart Mill so strenuously insisted, that there is scarcely any field of scientific inquiry so desirable or of such beneficent promise in the vast range of its practical applications.

The history and theory in general, and the practical outcome of both in our exist-

ing institutions and methods, ought certainly to be known at least in outline by all who are concerned in carrying on educational work, and with this there should go a more particular acquaintance with pedagogy in its proper sense,—that is to say, with the art of teaching. The history of education is strewn only too thickly with the wrecks of teachers who did not know the subjects they professed to know. It is no less thickly strewn with the wrecks of those who could not teach what they knew.

These are trite enough sayings, but they call up an old evil, which will become more and more menacing, unless it is remedied. The old world universities, pre-eminently the German, have long made provision to obviate it. The English and Scotch universities are slowly turning in the same direction and beginnings have been made in a few of our American universities.

This paper does not aim at arguing the matter, for the subject needs an extended presentation which cannot be given here. A few points, however, which will summarize the present situation in this country may not be out of place:

1. Teaching is becoming a profession in the sense in which law or medicine are professions. An increasing number of college-bred men are going into it for life, instead of as a make-shift for a short time.

2. The universities of the country are beginning to recognize this in the provision made for courses in the history, theory and practice of education.

3. Educational opinion is highly favorable to college-bred men as teachers, especially for the upper grades of instruction and the directive positions generally. This indicates that the wise policy for colleges and universities is not to attempt so much to qualify men for the conduct of the primary education, but to leave it, at least for a while, to the teachers bred at normal

schools, notwithstanding their lack of a liberal education. The colleges should aim to fill the secondary schools,—and more especially because from these must come the main supply of future college students.

The State now grants teaching certificates to Normal School graduates. Without interfering with this, let the State also grant teaching certificates to university graduates who have made a special study of education in addition to the subjects they intend to teach. Such teachers would be held at a high premium and would be sought especially by the better class of private schools. Headmasters are now complaining of the great scarcity of such men.

5. The idea that for a university professor eminence as an investigator and as a teacher are incompatible is beginning to find its answer in the scientific study of education, which presents the highest ideal of professional attainment as the possession of both. A professor is best equipped who knows his subject and knows the objects to whom he is to apply it. The historical university idea of the *facultas docendi* as a privilege given to one who proves himself truly a *doctor* or “teacher” is being more fully asserted.

6. Lastly, the provision made for the pedagogical preparation of teachers and professors and for the advancement of the study of educational systems and institutions is pitifully inadequate. A professorship founded and endowed to accomplish this end, will do more to extend steadily and hold permanently the influence of Princeton on the school life of this country and on the teaching ability of the college professors bred here, than any other provision that can be named involving equal expenditure. The field is yet open, but will not be so long, and the colleges which enter early will reap richly.

COMET d. 1889.

A large number of observations have lately been made at the Halsted Observatory upon the so-called “Comet d. 1889,” discovered by Brooks of Geneva, N. Y., last June. Though this comet has never been a conspicuous object, and is now so faint as to be beyond the reach of all but the largest telescopes, it possesses unusual interest in the recently developed evidence that it is identical with (or perhaps only a fragment of) the famous Lexell’s comet of 1770, which in 1779 was lost in consequence of an encounter with Jupiter. The credit of making this identification is due to Mr. S. C. Chandler of Cambridge, who, on working out the orbit of the present comet with its period of about 7 years, found that in May, 1886, it came within 6 million miles of Jupiter and was so situated that the present orbit would have resulted from the planet’s action upon a previous orbit, much larger and with a period of nearly 27 years. Reckoning back, four revolutions of the comet and twelve of Jupiter, bring us to 1779, when the planet and comet were before together, and just at the point where Lexell’s comet was lost. The probability is very great, therefore, that Brooks’ comet is really the “wanderer returned.” At the same time the uncertainties connected with all calculations of cometary motions are such that it is now of the utmost importance to secure as long and complete a series of observations as possible. Physically also the comet is interesting from the fact that in August it imitated Biela’s comet and the great comet of 1882 in dividing into several portions, or rather in throwing off (two) fragments, which however ceased to be visible some time ago.

NEW PLANT AT THE HALSTED OBSERVATORY.

The machinery for managing the dome of the Halsted observatory has recently been greatly improved by the addition of a storage battery and electric motor. Hitherto whenever the observatory was to be used, it was necessary to start the gas-engine, often a rather difficult operation, requiring the strength of a vigorous man, familiar with the whims and tricks of the machine; moreover, the engine had to be kept running during the whole time of observation, which was an annoyance on account of the noise, heat and tremor, to say nothing of the waste of power. With the new arrangement the machinery can be put in motion without any exertion of strength, simply by moving a few switches, and there is no waste when the motor is not actually at work. The motor is of 4-horse-power, and the battery consists of 32 Julien cells. At present it is charged in two series of 16 each by the small 55 volt dynamo which has been from the first a part of the outfit of the observatory. This is driven by the gas-engine, the charging being done from time to time by the janitor of the building, when not otherwise employed. Wires are run, however, to the dynamo house at the School of Science building, so that the battery can be charged from there, which will often be much more convenient. The former plant at the observatory remains intact so that in case of any failure of the battery or motor the old method of working is still available.

MEMORIAL WINDOWS IN THE CHAPEL.

The monuments which have thus far been placed in the Chapel have all been beautiful tributes to those whose memories we wish to preserve. The marble tablet to Professor Henry, in memory of one of whose scientific achievements every

Princetonian is justly proud, is in itself one of most charming mural tablets in this country, evincing the refined taste of A. Page Brown and the sculptural skill of Louis St. Gaudens.

The bronze monument to Dr. McCosh will give those who come after us a fine example of the workmanship of our foremost sculptor, Augustus St. Gaudens, as well as make it impossible for them to forget the administration which introduced a new era in the history of the College.

The beautiful windows which have recently been added to the Chapel are the gift of Mrs. Henry G. Marquand in memory of her son Frederick A. Marquand of the class of 1876. All who knew him will as they see these windows recall the straightforward, manly spirit and the gentle, winning manners that found for him through his brief life so many strongly-attached friends. It was perhaps unconsciously that the artist Francis Lathrop selected Jonathan and David to fill the longer windows, but do we not find something of each of them in the strong, but beautiful character whom the windows commemorate? The figure of Jonathan is a stalwart young man of great simplicity and force. We see in him the dauntless prince who was equally ready to brave armies or his father's frenzy, one who through the ages has stood for the ideal friendship. The figure of David is no less strong, but suggests a less impetuous character. He is the sweet singer of Israel, whose harp hangs over his shoulder, while in his hands he carries his sling and the great sword of Goliath. In these figures the flesh tints are painted, but the remainder is a mosaic of colored glass. Thus they harmonize in character as well as in color with the mosaic glass of the rose window above and at the same time have a distinct quality of their own. The drapery of the two figures is a remarkable instance of modelling in glass

as the folds and shadows are produced by an actual corrugation of the surface of the glass. The colors used are unusually simple and produce almost the effect of a monochrome. Between the two figures, the three smaller windows are filled with rich brown glass bearing the inscription: *Remember thy Creator in the days of thy youth, when the evil days come not, nor the years draw nigh, when thou shalt say, I have no pleasure in them.*

Before being placed in the chapel, the windows were exhibited in Philadelphia, in the Industrial Exhibition of the Pennsylvania Academy of Fine Arts, and received the first gold medal.

THE NEW ATHLETIC FIELD.

THE new University Athletic Field and the Winter Practice Building now in course of completion will enable a much larger number of students to engage in systematic team exercise than hitherto. The enlarged field will in a measure take the force from one of the strongest objections that can be urged against the present system of college sports that a baker's dozen actually exercise while hundreds look idly on. The Field more than doubles the area of the level which the college teams have been practicing upon since 1877. Four football elevens can play at the same hour in the autumn and twenty seven men can practice base-ball in the spring. The running track will have parallel with it a narrow bicycle track so that these two forms of exercise will not conflict. At the same time much will be done, gradually, in the way of the design of the grand stand and other buildings, and in the laying out of the road, pathways, terraces and the field lawn to make the whole surroundings of the college sports as attractive as possible. There is some probability that the Stand will be the gift of a single friend of athletics in Princeton. The general improvement

and alteration of the grounds will be paid for by subscription to a number of \$500 bonds, principally among the Alumni. The Winter Practice Building will be built by a contribution from the Foot-ball surplus and by subscriptions of the undergraduates and their friends amounting to upward of \$7500. It will be a permanent and substantial building with a clear inside area of 140x60 feet, or ground area of 8,400 feet. This will be completed by February 25th, and during the winter months relieve the overcrowded Gymnasium of all the spring athletic teams.

THE PRESBYTERIAN AND REFORMED REVIEW.

The vacancy left by the discontinuance of *The Presbyterian Review*, after an honorable life of ten years, has been promptly filled by a new *Presbyterian and Reformed Review*, in the editorial management of which Princeton Seminary has as prominent a place as in the old journal. The Editors of the new Review are Rev. Dr. Warfield of Princeton, Rev. Dr. Shedd of Union, Rev. Dr. Welch of Auburn, Rev. Dr. De Witt of McCormick, Rev. Dr. Jeffers of Western, Rev. Dr. Morris of Lane, and the Rev. Dr. Alexander of San Francisco Seminaries, together with Rev. Dr. Chambers of New York, Rev. Dr. Woodbridge of New Brunswick, and the Rev. Principal Caven of Toronto. Thus the chief Seminaries of the Presbyterian Church, the Reformed (Dutch) Church, and the Presbyterian Church in Canada are represented. The Review is to be a theological review, but in no narrow sense. Not only will it be comprehensive of the various departments of theological encyclopædia, but large attention will be given to philosophical, social, economical, historical and general literary subjects. A leading feature will be the careful criticism of the most important books of each quarter,—in which

sphere the late *Presbyterian Review* had no rival. Lovers of high thinking and good literature will find it to their interest to provide themselves with this journal, which will be published by the Messrs. Randolph & Co., at three dollars a year.

The initial number contains several articles by Princeton men. President Patton gives an extended paper entitled, "*On Preaching*," written in his incisive style. Dr. Macloskie discusses the recent Catholic Lay Congress. Dr. Davis of the Seminary elucidates in a most convincing way a chronological point in the history of the Assyrian conquests of Judea. And Professors Green, Hodge, Aiken, Paxton, Warfield, VanDyke of the Seminary, and Professors Shields, Macloskie, and Murray of the College are represented in the Book Reviews. Several of the other collaborators are honored Alumni of the College. This may illustrate the part Princeton College has in the journal. Papers are promised during the year from the following persons in the College: Ex-President McCosh on "Kant and his recent Critics," Prof. Frothingham on "Christian Art and Theology," Prof. Macloskie on "Science and Theology," Dean Murray on "Defoe," and Dr. Shields on "A Philosophical Theme." Among the more interesting provisions for the next few numbers will be a series of papers from competent hands, discussing the present condition of religious thought in the several parts of the protestant world. The first of these will be by Prof. Weidner on "Religious Thought among the Scandinavian Peoples."

Each number of the Review will consist of about 176 octavo pages, of which about 100 will be devoted to extended articles, about 50 to Book Notices, and the rest to brief notes on topics of current interest.

INTERNATIONAL COPYRIGHT.

On December 7th the Authors, Artists and Publishers of America gave a complimentary lunch at Delmonico's to the Count de Kératry. The object was an expression of adhesion to the idea of an international copyright law in America by which the rights of foreign authors should be guarded. The Count de Kératry came to this country to assist in the crusade that is being made in favor of such a law. He officially represented the *Société des Gens de Lettres* and other French literary societies. The gathering was a representative one and was a proof of the fact that all American publishers and artists, as well as authors, have rallied to the idea.

Princeton was represented by President Patton and Professors Osborn, Marquand, and Frothingham. Dr. Patton spoke as the representative of our educational institutions; among other speakers were Dr. Edward Eggleston, General Porter, Mr. Coudert, ex-Senator Chase. Bishop Potter presided, in the absence of Mr. Lowell, and the principal address was read in French by the Count de Kératry.

REVIEWS OF BOOKS.

HANDBOOK OF PSYCHOLOGY. SENSES AND INTELLECT. By James Mark Baldwin, Ph.D., Professor of Philosophy in Lake Forest University. New York: Henry Holt & Co. 1889.

Professor Baldwin's principal aim in the above treatise is to correlate the methods and results of modern specialism in the various departments of mental science with the general and received data of introspective Psychology. He also recognizes the need of adjusting the apparently conflicting claims of Empirical Psychology and Metaphysics. On this topic he remarks as follows in the preface of his book: "On the one hand empirical

investigation must precede rational interpretation, and this empirical investigation must be absolutely unhampered by fetters of dogmatism or preconception; on the other hand rational interpretation must be equally free in its own province, since progress from the individual to the general, from the detached fact to its universal meaning can be secured only by the judicious use of hypothesis both metaphysical and speculative. Starting with the empirical we run out at every step into the metempirical, and it is as destructive of sound results to omit the theory of the universal as to neglect the observation of particulars." In his metaphysical predilections Prof. Baldwin belongs to the modern Spiritualistic school of thinkers as opposed to materialism and sensationism.

Having defined the nature, scope and methods of the science in his introduction the author then proceeds to a classification and analysis of mental phenomena. Part I, on General Characteristics of Mind, discusses consciousness as the condition of mind in general, and attention in its bearings on mental function. In Part II, Intellect is treated under the heads of its two generic functions, the Apperceptive and Rational. Apperceptive, a term first introduced into philosophy by Kant and used in a different sense by contemporary Germans, is defined as "that activity of synthesis by which mental data of any kind (sensations, percepts, concepts) are constructed into higher forms of relation and the perception of things which are related becomes the perception of the relation of things." The apperceptive function includes all the ordinary mental operations, such as the *Presentative*, embracing sensation, perception and self-consciousness; the *Representative*, embracing memory with its subsidiary processes of retention, reproduction, recognition and localization in time; combination in its

two forms of association and imagination, and elaboration or the discursive function of thought proper. Chapter XII treats illusions and broaches a theory of explanation which is worthy of attention.

The discussion of the Rational or Regulative function of Reason is very brief and, perhaps on account of its brevity, is the least satisfactory portion of the book. Some of the noteworthy features of the volume are: first, its decided rejection of the unconscious from the data of psychology; second, the prominence given to attention, which is regarded as the general form of active consciousness and as the necessary condition of all mental synthesis; third, the employment of the term apperception as a generic name for that synthetic activity which is regarded as the most distinctive characteristic of mind.

The treatise throughout shows an extensive and intimate acquaintance with the latest result of scientific investigation. The analysis of the book is good, its style clear and forcible and it is in every way a welcome addition to the text-book literature of the science.

THE ELEMENTS OF ASTRONOMY. A Text-Book for use in High Schools and Academies. By Charles A. Young, Ph.D., LL.D., Professor of Astronomy in the College of New Jersey (Princeton). Boston (U. S. A.) and London, Ginn & Company, publishers, 1890.

This little book has been written for the use of high school students on the same general lines as those followed in the author's General Astronomy, which has already been noticed in the BULLETIN, (Vol. I, No. 2.) The necessary reduction in size has been attained by omitting those portions of the subject in which any but elementary mathematics are required, and by excluding, except for a mere reference now and then, the higher and more difficult portions of the topics discussed.

There is, however, no topic of fundamental importance that is not touched upon, and presented with as much clearness and exactness as the limitations imposed by the elementary nature of the book permitted. The author has shown it to be possible to deal with abstruse and difficult questions by a clear statement of the problem, and indication of the process of reasoning involved in it, and an explanation of the conclusion, in such a way that the ordinary reader will obtain as clear, if not as well grounded, a view of the matter as the student who investigates the same question by a more rigorous method. The book is characterized by the piquant and attractive style which is one of the features of the author's works.

In an appendix are gathered some matters which are of importance, though not essential, and which can be taken by students who are somewhat advanced. The book contains also a Uranography with four star-maps and descriptions of the principal constellations.

THE POETRY OF TENNYSON. By Henry Van Dyke. New York: Charles Scribner's Sons, 1889. pp. 296.

The outside of this book displays certain qualities which are also to be found in the inside. It is entirely removed from the commonplace, and yet it does not use cheap expedients to produce meretricious effects. Taste and honest labor have made a simple and beautiful binding; taste and honest labor have made a simple and beautiful book. The man who reads books without understanding them, the man who writes books without any study of literary art, may think the production of a work like this an easy matter. The style is so simple and natural that one forgets the effort necessary to acquire it, for the easiest reading is the hardest writing. The judgments are so

clearly uttered that one is apt to overlook the long work of forming them, for only the man who has mastered a subject can talk well about it without effort.

The writer has what in these days of unlimited production and machine made literature is growing rare: an ideal of workmanship. His book displays an increasing mastery of his craft, and there are many sentences in it which he might send to a fellow-workman as Dürer sent a sketch to Raphael to show his hand. Here and there indeed the stern critic might notice slight traces of a certain finicality at which he would smile indulgently. Not the affectation of vulgarity, for the marks of intellectual good breeding are on every page, but the occasional affectation of over-refinement like certain slight exaggerations of manner, speech or dress, often observable in men of birth and high cultivation. The writer is evidently a man of broad horizon and the tone of the book is uncommon because difficult. Adverse criticism is easy, adulation is easier; a discriminated admiration is the hardest of all because it requires a union of enthusiasm and self-control.

Mr. Van Dyke insinuates Tennyson as his candidate for the third place in English poetry. Such a nomination, however modestly made, is a prophecy, and contemporary prophecy about literary work is dangerous, because after all, time is the only test of great art. Whether Tennyson will form a triumvirate of English poetry with Shakespeare and Milton cannot be decided until the age of grand-sons; but the writer has clearly perceived and worthily illustrated the noble powers which constitute his claim for that position.

The most important part of this book is the chapter on "The Bible in Tennyson." This is more than literary criticism. It embodies a view of theology, a method of exegesis, a spirit in religion. Mr. Van Dyke regards the Bible as sacred *Literature*

and in the study of it his attention and enthusiasm are largely absorbed by its relations to personal, national and racial life. Such critics and exegetes are exactly fitted to the needs of the times, and he has given in short space a fine illustration of the spirit and method of interpretation which is most apt to help the young men of this generation to reverence and love the Bible, as the living word of the living God.

THE ODD NUMBER. A series of short stories, selected and translated from the French of Guy de Maupassant, by Jonathan Sturges. Harper Brothers.

Mr. Sturges was graduated at Princeton in '85, and later studied for some time abroad, making a specialty of German literature. He was prevented from taking a Ph.D., in Berlin by an attack of Roman fever, contracted while in Italy in the spring of 1887. He returned to New York the following autumn, and since has been devoting himself to literature, particularly the modern schools of Germany, England and France. At the request of the Harpers, he selected and translated these thirteen striking tales of Maupassant. The book is designed in charming form, and represents the taste of Mr. Clarence McIlvaine, Princeton '85, who is connected with the Harpers.

"The Odd Number" will form the first of a series of translations from foreign authors to be published by this house. The introduction by Henry James, gives one a fine idea of Maupassant's gifts and talents, which are perhaps best exhibited in short tales, such as these thirteen; and Mr. James as a critic is Mr. James in his best light, as shown in his brilliant "Partial Portraits." Here he dwells at more length on Guy de Maupassant and the artist is dissected by his fine critical skill. The volume opens with the story "Happiness," which, in method is fairly typical of the series, though in subject it stands

in wide contrast to such a harrowing tale as "La Mère Sauvage." The story Happiness is serene in its entirety. As tea-time approaches, the company congregate on the terrace of the villa overlooking the placid Mediterranean, and the sun in its last glory, brings in view on the horizon the Isle of Corsica, which seems at this moment to loom up only to quiet the gentle differences of the friends as they sip their tea; for through an experience on the mountain ridged Island, one of those present was able to maintain that love does last notwithstanding all, over many successive years. His heroine was a girl of France, rich, beautiful, who fifty years before had run away with an under officer in the regiment commanded by her father. The lover, a handsome young fellow, had noiselessly led away his fair one, and unbeknown to all her former world, until this man had found her, she had lovingly and happily lived without the elegancies of her former life, alone with him whom she loved, in this remote Corsican valley, and he had filled her life with happiness.

"The Coward," "The Wolf," "The Piece of String" are all strong tales. The pathetic sense of what need never have been in "The Necklace," and the calm, dreadful vengeance of "La Mère Sauvage" haunt one. The possibility of "Such a Confession" being a life's experience and the romance of "The Wreck" bring us to the end of thirteen master strokes from the artist's pen, and which through the skilful translation, retain the spirit and style of the author.

SUMMARIES OF PAPERS READ BEFORE SCIENTIFIC SOCIETIES.

REMINISCENCES OF EGYPT IN DORIC ARCHITECTURE.

By Prof. ALLAN MARQUAND.

In this paper an attempt was made to prove that the inheritance which Doric

Architecture received from Egypt was much greater than is usually supposed. The sacred temenos or enclosure containing the sacred olive, or oak or willow, or myrtle or laurel and its sacred spring, and with its altar for burnt offering in front of the temple seems to be a reminiscence of the Egyptian temenos with its sacred tamarisks and acacias and lotus flowers, with its sacred lake and its altar in front of the temple. The stepped pyramidal base, on which the Greek temple rests, is to be traced to Egyptian rather than to Mesopotamian prototypes. In Egypt also, the earliest instances are to be found of the peripteral temple and of the gable-roof. The Dorians preserved Egyptian methods of quarrying, cutting, lifting and laying large blocks of stone, of giving to the cella walls an inward slant and of covering them with stucco as a basis for polychromatic decoration. The Doric groundplan shows traces of the Egyptian peristyle and hypostyle halls as well as the sanctuary and of a similar gradation in level from the peristyle up to the sanctuary. All the peculiarities of the Doric column and capital: the diminution, entasis, channelling, annuli, echinus and abacus are found in and explained by the reed-bundle columns of Egypt. Ionic and Corinthian capitals exhibit similar traces of Egyptian ancestry. The Doric entablature by both the form and color of its triglyphal frieze betrays its relationship to the Egyptian cornice and the ordinary mouldings and painted ornaments are derivatives of well-known Egyptian forms. Even such a refinement as the use of curved surfaces was not first tried at Corinth or Pæstum or Athens, but is to be seen in the slightly curved gable-ceiling in one of the tombs of Beni Hassan

and in the curved architraves of the temple at Medinet Abou.

[Read before the American Oriental Society, Oct. 30th, 1889.]

PROFESSOR HUNT'S RECENT WORK.

On Dec. 2, 1889, Professor Hunt read a second paper on Standard Types of English Style, before the Presbyterian Ministerial Association in Philadelphia. The object of the paper was to show the true relation of the mental and emotive elements in style. The need of force or vigor in modern English Style was especially emphasized.

On Dec. 28, 1889, Prof. Hunt presented a paper at the meeting of the Modern Language Association, held at Harvard College. The topic discussed was Literary Judgments. After showing that such judgments were dependent, in a sense, on literary precedent, opinion and environment, it was the special purpose of the paper to press the claims of freedom of judgment in the sphere of Letters and Style. Such personal liberty is demanded, it was argued, by self-respect, by the ever increasing list of unsettled questions before the mind of the student and as a needed protest against all forms of intellectual and literary servility.

In MODERN LANGUAGE NOTES for January, Prof. Hunt presents a critical review of Prof. Corson's recent treatise, "An Introduction to the Study of Shakespeare." While taking exception to some of the positions held by Prof. Corson, the critique is, in the main, constructive and favorable, special praise being given to the author on the ground of his courage and candor and his sympathetic interpretation of the great English Dramatist.

The Third Edition of Prof. Hunt's Principles of Discourse has recently appeared.

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. II.

APRIL, 1890.

No. 2.

THE PRESIDENT'S REPORT TO THE BOARD OF TRUSTEES.

We give below an abstract of the Report made by the President to the Board of Trustees at their meeting held on February 13th.

"I have asked Mr. A. B. Woodford, formerly professor in the State University of Indiana, to give instruction during the present term in Political Economy and Constitutional Law to the Junior and Senior Classes. He has already entered upon his work.

Since the last meeting of the Board the College has sustained a serious loss in the death of Dr. Frederic Vinton, who, after a painful illness, departed this life on the first day of January. Dr. Vinton was a man of rare bibliographical knowledge and a scholar of exceptional attainments. He devoted himself with singular fidelity to the duties of his position; and the College owes a great deal to his untiring industry during the seventeen years of his service as Librarian.

Professors Marquand and Frothingham are of the opinion that it would prevent confusion on the part of students in the choice of their electives, if the professorships which they respectively hold were designated in the catalogue by the same title. I concur in this opinion, and suggest after conference with the Professors concerned that the title be Professor of Archæology and the History of Art.

Dr. McCosh desires me to say that he would be glad if the Trustees would authorize the use of last year's unexpended interest on the McCosh Fund, as a second prize for this year, in the department of Mental Science.

The Day of Prayer for Colleges was appropriately observed. Religious services conducted by the Rev. Dr. Purves of Pittsburgh, were held in Marquand Chapel in the afternoon and evening. They were well attended by the students and were of marked interest."

The Trustees elected Professor Woodrow Wilson, of Wesleyan University, as Professor of Jurisprudence and Political Economy. He has expressed his intention to accept. Professor Wilson graduated at Princeton in 1879 and studied law and politics at the Johns Hopkins University, where he took the degree of Doctor of Philosophy. He is the author of some important works, studies in American politics.

LOCAL EXAMINATIONS FOR ENTRANCE TO COLLEGE.

By H. B. FINE,
PROFESSOR OF MATHEMATICS.

Since 1876 the June examinations for entrance to the Freshman class have been held simultaneously at Princeton and several of the larger cities and schools of the country.

These "local" examinations were instituted to save candidates for admission who lived at a distance from Princeton

the expense and inconvenience of a long journey of uncertain issue. They were at first offered at distant cities only—Pittsburgh, Cincinnati, Louisville, Chicago, St. Louis, San Francisco—but a little later in the New England schools also.

Each city Local was entrusted to the care of some responsible alumnus or friend of the College. He made all necessary arrangements for holding the examination, had the time and place of its occurrence properly announced in the local press, conducted the examination itself—with copies of the papers prepared for the Princeton examination and forwarded to him in advance—and sent the written answers of the applicants back to Princeton to be passed upon by the examiners there. The costs of advertising were of course met by the College.

With three exceptions to be mentioned immediately, this still remains the method after which the city Locals are conducted. The same method is followed in the school Locals—except that the principal of the school is there the person in charge.

In recent years preliminary as well as complete examinations for entrance have been allowed at the Locals, as at Princeton.

In June, 1888, trial was made of an examination at Philadelphia conducted by members of the Faculty. The number of men coming up annually from Philadelphia and Eastern Pennsylvania is large, and a wish was felt to save them the annoyance of the journey to Princeton, and hot and crowded quarters while here. That same June, the Pittsburgh examination was also conducted by a Faculty examiner.

The unusual success and satisfactoriness of these examinations made it evident that the Philadelphia Local must be continued and a Local established in New York. Also that there are great advantages in having members of the Faculty in charge of local examinations wherever practicable.

Besides adding to the dignity and importance of the examination, their presence makes possible its extension to candidates for entrance to the higher years of the course, and secures a juster treatment of candidates of uneven or faulty preparation who suffer from a lack of examination experience. It has already proved beneficial in familiarizing teachers with college methods of examining, in reminding the Faculty freshly of the actual character of school preparation and in promoting generally a better understanding between the schools and the College. Indeed wherever the number of candidates is large, the presence of a Faculty examiner is indispensable to the success of a local examination. It is unfortunate therefore that the College has no adequate fund to devote to the Locals; Faculty examiners should be sent not only to New York, Philadelphia and Pittsburgh, but certainly to Washington or Baltimore and to Chicago.

The increased number and importance of the local examinations led in the spring of 1889 to the organization of a committee of the Faculty for their proper management. Every effort was made by this committee to establish Locals wherever they were needed, with the result that examinations for entrance were held last June at 32 points besides Princeton—New York being one of them. Of 130 candidates for admission to the Freshman class of the Academic department, 72 were examined at the Locals; of 65 candidates for the Freshman class of the School of Science, 33 at the Locals; of 81 who took Academic preliminaries, 60; of 20 who took Scientific preliminaries, 14; or about three-fifths of all who took examinations appeared at the Locals.

Of these Locals much the largest was that held (for the first time) in New York. Sixty-one men took the examinations there preliminary and final.

The great success of this Local was due in large part to the vigorous support of the Princeton Club of New York, which not only took charge of the necessary arrangements, but sent out an announcement regarding the examination to all the schools of the city and vicinity, had it fully advertised and noticed in the city press and offered a prize of \$100 to the candidate who should pass highest at the Local.

The Philadelphia, Baltimore and Wilkes-barre Locals last June had the benefit of similar support from the Alumni Associations of those cities. In Philadelphia Mr. G. W. Childs offered an entrance prize of \$50, and in Erie, Pa., Mr. Wm. Spencer a prize of the same amount.

It is to be hoped that the Alumni Associations of the College generally will follow these admirable precedents. Their organized and official cooperation could easily double the efficiency of all the more important Locals.

The Faculty Committee will in the main pursue the same policy this year as last. The old Locals will be maintained and strengthened and new Locals established wherever they are really desirable. Profiting by a year's experience, however, the Committee will strive to avoid all unnecessary multiplication of examinations. More is to be gained by concentration of effort on central points at which the examinations have been well attended in previous years than by trial of any new points except those at which a number of applicants is assured in advance. Care will be taken to have the examinations announced as generally as the fund at the disposal of the Committee permits. This fund is wretchedly inadequate and should be increased immediately. Beside crippling the Committee in properly advertising the examinations, its smallness prevents the sending out of Faculty examiners to cities where their presence would be of great advantage to the College.

The Committee will gladly avail itself of the cooperation of the Alumni wherever it is offered.

FREDERIC VINTON.

FREDERIC VINTON, Librarian of the College, died in the first hour of the new year. His last illness was short—he was at his desk on the day College closed for the Christmas holidays—but his health had been failing for a long time. For nearly forty years Mr. Vinton was engaged in library work. In that time the direction of a library had risen to the dignity of a profession, and to this result no one contributed more than Mr. Vinton in the evolution of a scientific system and method.

Mr. Vinton was born in Boston, Oct. 9th, 1817. He was fitted for college at Brain-tree Academy, and graduated from Amherst in 1837. Later he studied theology, one year, at New Haven, and two at Andover, graduating in 1843. He preached for a short time only, and was not ordained. Poor health compelled him to give up preaching, and for several years he taught school, the High school in Nantucket, and afterward that in Eastport, Me. At this period he suffered an attack of paralysis, which for a time took away his speech, and again another which affected his limbs, and he was for a long time in the hospital. This sickness determined his course of life. While still an invalid he went to St. Louis, and there, together with other literary work, he executed a manuscript-catalogue of his brother's library of some 5,000 volumes. The books were entered by authors, by titles, and by thorough subject analysis, making a catalogue of about 2,400 pp. folio. The execution is beautiful—not a blot or an erasure,—and the work itself is done with such minute accuracy that although the library is dispersed, this

catalogue has a permanent bibliographical value. This work led, on his return East in 1856, to his appointment as assistant-librarian in the Boston Public Library, where he had charge of the arrangement of 30,000 volumes in Bates Hall, then first occupied. He also made an index and a supplement to the catalogue. In 1865 he was called to Washington as first assistant in the Congressional Library. Here he prepared six of the supplementary subject catalogues, together making two large volumes.

Mr. Vinton came to Princeton in 1873. The new building was just ready for occupation, and Mr. Vinton's first work was the laborious one of moving and re-classifying the books under a more scientific arrangement. The Library then had 18,000 volumes, and the Trendelenburg library of some 10,000 was soon added. This purchase added many rare books, but not many for common use. Less than half the total number of books, Mr. Vinton estimated, were useful in a working library. We read with amazement, from a list Mr. Vinton at once prepared, the titles of standard and indispensable books then not on our shelves. Mr. Vinton set himself to fill out these *lacunae*, and especially to add books in all departments which should be useful to the students not less than to the Faculty. One of his early reports is a special plea for means to buy books that shall attract students to use the Library. In his first year the borrowers out of 400 students average only 26 each library day, "a per diem of 1-16th of a man." Nothing shows better the changed character of the library than the figures for the current year which show an average of over 60 books taken each day. In addition to the regular income of the Elizabeth Foundation fund Mr. Vinton had frequent special gifts from the same generous source. Separate author and subject card catalogues were at once begun, and

in 1884 the subject-catalogue was printed in a volume of 900 pages, double column. By this time the library, grown symmetrical and increased to 70,000 volumes, was worthy of the college. Nevertheless, Mr. Vinton has left a carefully prepared list of perhaps a 1,000 titles of single books and sets essential to the completeness of a University library.

Mr. Vinton's most striking characteristic as a librarian and as a man was the conscientiousness and fidelity to principle which dominated his every action. In the routine of the library and in the arrangement of the books he practised a rigorously consistent and logical system, and he regarded an apprehension of this system as in itself a valuable intellectual discipline to the students. Clear in the mind of the librarian, the system was not always evident to the student, and the student oftentimes resented the intellectual gymnastic administered from the desk before his query was answered. In the end no one could be more patient in resolving a student's perplexity or obliging in finding or suggesting needed books. Experience only can make one appreciate the trials of patience from the perversities of human nature to one who stands at desk or counter. And Mr. Vinton during the latter part of his life was often in sharp physical suffering, borne quietly and heroically, while he stood at his post.

Mr. Vinton was a man of wide reading, and his profession led him into out-of-the-way fields of research. His knowledge was diversified and recondite. He used to quote approvingly the Spanish motto, "He that sells oil, anoints his own hands." At Washington his helpfulness to Charles Sumner led to a warm personal friendship. And here his literary and historical knowledge outside of the beaten paths has often enabled him to teach the teachers, and always with evident delight. From a boy he was devoted to historical

study, and the sections of English literature and history—if he had his favorites—were those which he took pride in filling out, and in these sections the library is perhaps strongest to-day.

The great catalogue was the crowning work of his life. It has elicited the heartiest commendations from those qualified to judge of such work. The ordinary library user seeks a well-known book and finds it from the cards; but this volume shows at a glance the resources of the library in a given subject, guides the learner, aids the specialist, and shows abroad the bulk of what our library contains. It will always have a value as a subject-analysis, even though in some re-arrangement it should cease to be a guide to the shelves.

Mr. Vinton, with little leisure, wrote many articles for periodicals. A partial list of them added below will show his favorite lines of research. Mr. Vinton did much untrumpeted Christian work among the poor of the village, and by some of the titles it will appear how warm an interest he took in Missions. He has left in manuscript a very interesting lecture on Manuscript Illumination, and, partly finished, *Reminiscences of Maria Mitchell*, the astronomer, recently deceased, who was an intimate friend from childhood. The annual reports to the Trustees furnish a complete history of the library under Mr. Vinton's administration, with valuable statistics.

Mr. Vinton's constant fidelity to the duties of his office through seventeen years of service in the college is beyond praise. Of itself, apart from his admirable qualities as a man and librarian, it distinguished him, and will not soon be forgotten.

In 1886 he received the degree of *LITT. D.* from Amherst College.

Articles:—*St. Patrick's Purgatory and the Inferno of Dante*, *Book Rarities at Washington*, *President Witherspoon*, *His-*

tory of the College Library (in the Princeton Book), *Training of Assistants in a Library*, *Vernacular Bibles and the Reformation*, *The First Atlas ever Published (in our library)*, *One of the Oldest American Books (Simple Cobbler of Aggawam, —in our library)*, *Sir John Mandeville*, *Barlaam and Josaphat*, *Tyndale's Pentateuch*, *Ancient Hebrews and Modern Jews*, *Stanley's Congo and Dark Continent*, *France and Madagascar*; *Patteson, the Missionary and Martyr*; *Alaska as a field for Missions*; *Henry Martyn*.

THE STONE LECTURES FOR 1890.

By J. H. DULLES,

LIBRARIAN OF THE THEOLOGICAL SEMINARY.

The Reverend Henry J. Van Dyke, D.D., of Brooklyn, was the lecturer this year upon the L. P. Stone foundation in the Theological Seminary. His subject, "The Ministry and the Sacraments of the Church," was developed in seven lectures. The first of these treated of "The Church, Visible and Invisible." The definition of the Church adopted was that given in the Westminster Confession. The possibilities of salvation are not to be limited, except as limited by the express teachings of Scripture. The salvation of all infants dying in infancy may be safely taught. Christ's relations are cosmic. The visible church includes all who profess the true religion and their children. It is a reality and is the true church, inaugurated by Christ.

The theme of the second lecture was, "The Visible Church is the Kingdom of Christ." Its independence of all human governments was insisted upon. It is directly responsible to Christ its King. It is identical with the kingdom announced by John the Baptist and instituted by Christ.

In the third lecture, "The Unity of the Visible Church" was discussed. It is the body of Christ, having many members

but being one body. This unity does not depend upon human creeds, forms of government, or modes of worship. Its essential conditions are the confession of Christ, the living ministry, the preaching of the gospel, and the administration of the sacraments. The divisions of Christendom are accidental, due to human limitations in the apprehension of truth and in personal sanctification. No single denomination has any Scripture warrant for calling itself The Church. There is a growing desire for union. The recent overtures of the Episcopal Church in this country do not meet the difficulty. A practical union must include recognition, cooperation, and federation.

"The Church-membership of Infants," was the subject of Lecture IV. The Church is one under all dispensations. The covenant with Abraham is the perpetual charter of the Church and included infants. Baptism is identical with circumcision, just as the Lord's Supper is the antitype of the Passover. The children of believers are by birthright members of the visible church. They are not baptized in order to be regenerated, but upon the presumption that they are regenerated.

"Ordination to the Christian Ministry," was considered in the fifth lecture. What is ordination? and, who have a right to ordain? are the vital questions. The position of the Episcopal Church as opposed to that of all other Protestant denominations was stated. No warrant was found in the Bible or in the apostolic church for the existence of diocesan bishops as a distinct order. There is no proof that the apostles claimed the exclusive right to ordain, or that they transmitted such right to successors in the apostolic office. The only bishops recognized in the New Testament are presbyters, and through them the ministers of all Christian churches are in true apostolic succession, and have the right to ordain.

Lecture VI was upon "The Lord's Supper." Four theories were noticed: The Roman Catholic, the Lutheran, the Zwinglian, and the Calvinistic. The last was upheld by Dr. Van Dyke. The Westminster standards, the XXXIX Articles, and the Episcopal Prayer-Book are in accord in this. A "real presence," free from the errors of consubstantiation and transubstantiation and of a meagre memorialism, was maintained. Believers receive in the sacrament the real Christ.

The seventh and last lecture dealt with "The Administration of the Sacraments." There are only two, and they are of universal obligation, being means of grace equally with prayer and the Word of God. They may only be dispensed by a lawfully ordained minister. Baptism was first considered and its mode shown to be unessential, except that water must be used in its administration. The essential physical elements in the celebration of the Lord's Supper are bread and wine. These are necessary, true bread and true wine. In admitting candidates to the sealing ordinances, their regeneration is assumed, but never authoritatively declared. All baptized children should be encouraged to come early to the Lord's table, having from infancy been treated as the regenerated children of God.

THE BIOLOGICAL CLUB.

The members of the Biological Department have recently organized a society to be known as the Princeton Biological Club. Its purposes are similar to those of the various Scientific *Vereine* which are such popular and helpful features of German University life, namely to attract all who are actively interested whether as teachers, students or investigators, to a series of very informal meetings in which the social as well as the intellectual element is made

a feature. All University students as well as the Fellows and Instructors in Biology and Geology are eligible for regular membership; members of the Junior and Senior classes may become Associates, while a third class consists of honorary and non-resident members. The Club at present has twenty active members.

There are four general topics for the meetings, *a.* original papers or addresses; *b.* reports upon original investigation; *c.* stated discussions upon questions of especial current interest; *d.* reports upon periodical literature, and recent methods of technique and research. At the meetings already held the principal subjects have been as follows: On the opening evening Professor Scott gave an account of the last Princeton Scientific Expedition to Oregon, with preliminary observations upon the newly discovered mammalia and a description of the geology of the country. The second evening, Dr. Rankin gave a summary of his investigations upon the anatomy and physiology of the Organ of Bojanus in the fresh-water Mussel; Dr. Osborn reported upon the Perissodactyla of the Uinta formation and his studies of the Mammalia of the Cernaysian Beds near Rheims, France; Dr. Scott gave the conclusions he has recently reached in regard to the evolution of the Canidae. At the third meeting, C. F. W. McClure, ex-Biological Fellow, gave an abstract of his paper upon the primitive segmentation of the vertebrate brain. The last meeting, upon March 20th, was given to a symposium upon Heredity, introduced by four short papers, by different members, upon the theories of Lamarck, Nägeli, Weismann and Darwin. At the first election Dr. Hill was chosen President, Dr. Rankin, Secretary, and Prof. Macloskie and Mr. Phillips, members of the Executive Committee.

DR. McCOSH'S UNIVERSITY LECTURES.

On retiring from the Presidency Dr. McCosh was asked by the Trustees to lecture from time to time, as he was able, on Philosophy. Last year he gave two courses of lectures, one on Fundamental Truths, the other on the Tests of Truth, both of which have been published and widely circulated in this country and Great Britain. This year he has delivered three University Lectures on the subject: "THE PREVAILING TYPES OF PHILOSOPHY; CAN THEY REACH REALITY LOGICALLY?" In Lecture I., he explained the nature of Reality, showed that we perceive it intuitively, and that it is to be assumed in all true philosophy. He then inquired whether Reality is to be found in the three prevailing schools of Philosophy:—the Empirical, the A Priori, and the Scottish. He showed that the Empirical could not reach Reality; that with Mr. Mill it could give us in Body merely "the possibility of sensations" and in Mind, merely "a Series of Sensations aware of itself." In Lecture II., he took up the A Priori or Kantian school, and showed that it has merely Forms, Categories and Ideas and not Things; and that it necessarily and avowedly ended, not just in deceptions but in *illusions*. In Lecture III., he examined the Scottish School, and showed that it professed and meant to be realistic; but that in the works of Reid and Stewart it did not make us look directly on things, and showed us qualities instead of things with their qualities; and in the works of Hamilton made all knowledge relative, and not positive, and thus issued as Hamilton avowed in nescience. He showed that as Hume appeared in last century to expose the errors of Descartes, Locke and Berkeley, so Herbert Spencer had appeared in this century as an avenger, and was driving the prevailing philosophies to Agnosticism. In these circumstances he held that philosophy must start anew and

afresh; must assume Reality as self-evident, and proceed upon it throughout. These three lectures are so far negative and destructive as opposing errors, and should take along with them the lectures of last year as being positive and constructive. It is only in this way that Agnosticism, which is the prevailing philosophy of the day, can be met. These lectures are at present appearing in the *Independent*, and in October will be published by Macmillan, of London, and Scribner, of New York, in a small volume.

ORIGINAL CONTRIBUTIONS.

OUTLINE OF STUDIES IN FORMAL DEVELOPMENT OF ELIZABETHAN DRAMA.

By M. M. MILLER,
INSTRUCTOR IN ENGLISH.

THE DRAMATIC ART-FORM (VERSE).

(1) Early rude riming meters of the mystery-plays, etc.; their good qualities preserved and imperfections corrected by

(2) The ballad-meter of the second period (the commonly despised "Cambyse's vein"). High character of its actual and potential verse-qualities. Influence of these upon

(3) Blank verse. Stilted pentameter of classic imitators (Sackville and Norton, etc.) introduced as the measure for set speeches, etc., into rimed plays. Reactionary effect of the ballad-meter upon it. It becomes a freer, more representative art-form, and finally establishes itself, in plays of the Tamburlaine type, as

(4) The normal dramatic verse, the variant pentameter of Shakspeare. Disregard for harmonious development leads to

(5) Decline.

(a) Over-elaboration of form results in too subtle verse-melodies of Beaumont and Fletcher.

(b) Too great interest in what was once mere by-play, unversified padding, (realistic speeches of clowns, city-gallants, etc.) foretells the coming prose comedy of the Restoration. Seen in Field, *et al.*

(c) Undue adaptation of verse to rhetorical declamation prepares for reversion to classic pentameter in the form of the French heroic of Dryden, etc. Seen in Massinger, *et al.*

DRAMATIC ADJUNCTS (MUSIC, DANCE, SCENIC EFFECT, ETC.)

1. Effects of absence of adjuncts and poverty of theatrical equipment.

(a) Art-form (verse) compelled to become elaborate. Poetry therefore highly ornate, descriptive and imaginative.

(b) Interest concentrated on impersonation. This results in characterization consonant in every part.

(c) Direct effect in rendering audience imaginative and consequent indirect influence in same direction upon the plot.

(d) Almost pastoral orchestration and the absence of choral music cause the songs introduced to take the form of simple lyrics of pure melody.

(e) Primitive staging, etc., of the mystery plays the model of the later theater. Consequent effect on the drama.

(f) Freedom of dramatic composition limited by fewness of actors and "properties."

2. Recognition of lack of harmony between the acting and its adjuncts the precursor of development toward the modern opera and spectacular play. The partnership, rather than union, existing between these two factors, as seen in the pageant and masque, led to rapid development and as speedy dissolution. The fame of the artist obscured by that of the author. The masque thus ends as a simple poem (see Comus), or, if acted, with no more adjuncts than those of the drama proper.

LAWS AND FORMS OF DRAMATIC COMPOSITION
(PLOT, CHARACTERIZATION, ETC.)

1. Mysteries, moralities and interludes. Their influence upon occasional forms in later drama, allegory, set types of character, grandiloquence, bloody catastrophe, combination of low comedy with tragedy, double plot, etc.

2. Classic imitations. Observance of "the unities" antagonistic to native development towards higher laws; thus

(a) Popular spirit of romance, — the result of the new freedom of thought and expression from convention, — places the law of imagination above that of unity of time.

(b) Popular interest in shifting scenes of adventure and discovery depicted in books of travel, etc., places the law of variety above that of unity of place.

(c) Popular interest in personality; the existence of traditional styles of acting, "star" players to whose special qualities plays were adapted by dramatists who themselves had had practical experience in acting; this, with

(d) Popular interest in historical and "picaresque" narration, the stories of favorite kings and adventurers, leads to unity of characterization at expense of fact and probability. The reverence for the traditional accounts explains anachronisms, etc.

(e) Popular interest in contemporary events, comic or tragic, "merry jests" or "horrible murders," places law of present and personal interest, (naturalism) above that of artistic subject-matter, (romanticism.)

(f) Popular interest in novelties; curiosity about monstrosities in mind and matter; speculations concerning the supernatural, etc., together with

(g) The scientific spirit of description and classification seen in the depiction of individual and race characteristics,

of fashions, fads and "humors,"—place, to speak comprehensively, the unity of thought above the unity of action.

3. Decline.

(a) Undue stress laid in turn upon the laws which brought freedom from the old restraints, (Massinger in plot, Marston in characterization, etc.) together with

(b) Imitation of masters in certain admired particulars, (Shakespeare's humor imitated by Randolph, his philosophy by Suckling), — cause return to spirit of classicism.

THE ROMAN SCULPTORS OF THE
MIDDLE AGES.

By A. L. FROTHINGHAM, JR.,

PROFESSOR OF ARCHAEOLOGY AND THE HISTORY OF ART.

Vasari's two-fold characteristic of a lover of the Renaissance and a fanatical Tuscan led to his disparagement of early work wherever it was found outside the limits of his beloved province. There may be in this trait more of ignorance than of prejudice. At all events, his judgments are now under revision. Much that is new has been published lately touching the schools of both Northern and Southern Italy. It is also time for a rehabilitation of the Roman school, with the primary object of showing how prominent a share it took in the Revival of the XIII century. In Tuscany the revival was led by Niccola and Giovanni Pisano in the art of sculpture. It has been asserted that Giovanni di Cosma, the only Roman artist whose works seem to have hitherto attracted attention, was a pupil of Giovanni Pisano, and the Roman school was thus made an offshoot of the Pisan. (1). I expect to prove in the *Journal of Archaeology*, that Giovanni di Cosma, whose works date from about 1286 to 1303, was almost the last of a long line of Roman sculptors whose names are known, as well as some of their works.

(2). Furthermore, that the revival in sculpture took place in Rome c. 1250, at the same time as at Pisa, and was thoroughly independent. (3). The Roman artists produced between 1250 and 1300, more works than those of the Pisan school and, in some respects, exercised a strong influence over their Tuscan brethren. (4). In sculpture as well as architecture the Roman school was the best reviver and student of classic traditions.

The region that witnessed the activity of the artists we term the Roman extended from the borders of Tuscany on the north to the frontier of the Neapolitan province on the south; from the Mediterranean on the west nearly across to the Adriatic. It therefore includes parts of Etruria, Umbria, the Abruzzi and the whole of Sabina, Latium (Campania), and Marittima. During the eleventh and first half of the twelfth centuries there were no such attempts made at figured sculpture as resulted, in the rest of Italy, in such helplessly grotesque or at best inartistic productions. The two earliest schools of Paulus (about 1090 to 1180) and Ranuccius (about 1130 to 1209), produced architects and mosaicists but no sculptors; even decorative carving was of the most summary description.

The last scion of the school of Paulus, *Nicolaus*, united with the founder of a new school, *Vassalletus*, in producing the earliest signed work known to us, the paschal candlestick at the basilica of S. Paolo in Rome: its date is between 1170 and 1180. Its entire height is covered with small figures representing scenes in the life of Christ, while above and below are a number of lions, sphinxes and non-descript figures from the Bestiaries. A paschal candlestick of the same style but of better execution is to be seen in the Palatine Chapel at Palermo, and is slightly anterior, apparently, to the one at Rome. A Roman artist left his name in Monreale,

at this time. May not the artistic relations of the two regions have led to the introduction of a taste of figured sculpture in Rome from the South? The third sculptor's name is that of *Andreas*, whose finest remaining work is the choir screen in S. Pietro at Alba Fucense, executed somewhere between 1200 and 1250. A relief and a row of busts, almost life-size, standing on the upper part of the screen, show considerable rude strength and originality. He belonged to a family of artists whose works were mainly in decorative mosaics.

The renaissance in sculpture, however, seems to have been due to another artist, *Vassalletus*, a descendant of one of the authors of the paschal candlestick at S. Paolo. He was equally well known and eminent as architect, decorator and sculptor, and lived a long and busy life. His activity extended over a period of half a century, from about 1225 to 1270. He therefore slightly antedates the leader of the revival in Tuscany, Nicola Pisano (†1278), whose earliest works are between 1230 and 1240.

Vassalletus worked in most of the great basilicas of the Eternal City, at St. Peter's, S. Croce, SS. Apostoli, S. Giovanni Laterano, etc. His fame and his works travelled northward as far as Viterbo and southward through Campania (e. g. Anagni). He calls himself a Roman, *Vasaleto de Roma*, on the episcopal throne which he executed for S. Andrea at Anagni. The work that will forever perpetuate his fame is the famous cloister of St. Giovanni Laterano, which his father began and he finished. The great lions and sphinxes of this cloister, with their noble heads and symmetrical forms, do not suffer by comparison with the lions under the Pisan pulpit by Nicola Pisano (1260), which they antedate by thirty or forty years. The same qualities of breadth and expression are to be found in the lions of the throne at Anagni, dated 1268, toward

the close of his career. What he was capable of doing when he attempted the human figure is shown by a monument whose attribution to him I shall seek to prove elsewhere. This is the monument of Pope Hadrian V, at Viterbo, executed on the death of the pope in 1276. It already has the Gothic canopy, afterwards adopted by Giovanni Cosmati; and the reclining figure of the pope, although stiff, is refined and dignified, its drapery being arranged in carefully studied and delicate folds. Opposite it in the same church of S. Francesco at Viterbo, at present stands a similar monument, that of Clement IV, executed still earlier, in 1268, by *Petrus Oderisi*, another Roman artist. The general arrangement is the same, but the figure is inferior in refinement and artistic value. Similar monuments, probably by these artists, were erected at this time in the churches of Viterbo to the Vico family and to Card. Le Gros.

From this time sculpture flourished among the Roman schools and their works are even now quite numerous. Their originality lay in two branches: tombs and altar canopies. The Pisan school devoted itself at first almost entirely to pulpits; as a result it soon excelled in elaborate compositions in relief, whereas the Romans neglected reliefs and developed the study of the single figure cut entirely or almost in the round. The earlier altar canopies had been decorated with mosaics: now sculpture was profusely employed and statuettes and reliefs filled every empty space. Such were those at S. Paolo executed in 1282, and at Sta. Cecilia, whose date, according to Ugonio, was 1283.

Then came many works in quick succession. At St. John Lateran there remain the statues of Peter and Paul, which stood in front of the church, the kneeling figure of Nicholas IV, the monument of Card. Petrus de Piperno (by

Giovanni Cosmati?) the chapel of Card. Colonna (by Adeodatus?) the altar canopy and altar of Sta. Maria Maddalena by Adeodatus, and several minor works. At Sta. Maria Maggiore, the tomb of Honorius III, the reliefs and group of the *Præsepe* in the chapel, and the tomb of Card. Gonsalvo by Giovanni di Cosma (1299). At Sta. Maria in Ara Coeli, the tombs of Honorius IV, (1285-8), of the Savelli, and of Cardinal Matteo d'Acquasparta. At Sta. Maria sopra Minerva, the monument of Bishop Durand by Giovanni di Cosma, who was also the author of the tomb of Card. de Surdi at Sta. Balbina. In the crypt of St. Peter's the monument and figures of Boniface VIII by Giovanni di Cosma, and of several prelates belonging to this period. At Sta. Prassede the beautiful figure of Card. Anchera, by one who must have been the best artist of his time (1286), judging from the breadth and harmony of the drapery and the softness in the treatment of the features. In 1258 the seated statue of Charles of Anjou was executed by order of the senate. A little later that of Boniface VIII was placed on the outside of the Cathedral at Anagni. At Grottaferrata the Counts of Tusculum erected a family mausoleum in the Basilian monastery.

With a couple of exceptions all these works are anterior to the year 1300. They are mostly by the hands of four or five artists: Vassallectus, Pascalis, Joannes Cosmati, Petrus, and Adeodatus. We know also of an Ivo and a Jacobus Cosmati who worked in 1293 at Orvieto. One of the peculiarities of this early Roman school is its ability to execute large-sized figures in the round in which a certain classic feeling is still shown in the treatment of the drapery. It so happens that an early document mentions a statue of Aesculapius as being set up in the workshop of the Cosmati, the principal family of artists during the XIII. century.

Niccola, Giovanni and Arnolfo were the three principal artists of the Pisan school from 1250 to 1300. Their works are not as numerous as those of the contemporary Roman artists, but their art is more varied and advanced: it has greater life, naturalness and dramatic power. The Roman style is dignified and inclined to heaviness.

In certain works, like the canopy of Sta Cecilia, it attains as much beauty of form, delicacy of treatment and charm of style as the best Pisan works. Both Giovanni and Arnolfo felt the influence of the Roman artists rather than the reverse. When Arnolfo executed in 1280 his one authentic work, the monument of Cardinal de Braye at Orvieto, he copied faithfully the type of Petrus Oderisi and Vassallettus as shown in the Papal monuments executed by them at Viterbo between 1268 and 1276; he used even the mosaic decoration, which must have been executed for him by a Roman artist. When Giovanni Pisano erected in 1305, at Perugia, the monument of Pope Benedict XI, he copied the Roman type, even to the angels holding back the drapery, a peculiarity wrongly conjectured to be original with him.

It would be possible to give quite a list of works of sculpture by Roman artists during the XIV century, such as the excellent figures of SS. Peter and Paul at Sta. Croce in Jerusalemme, that of St. Michael at S. Giovanni Laterano, etc., etc., but my object has been solely to vindicate for the Roman school in the revival of sculpture in Italy in the XIII century a larger share than can be conceded to any other beside the Pisan. Such a position has never been claimed for it.

*THE INTERACTION OF SULPHURETTED
HYDROGEN AND THE ORTHOARSEN-
IATES OF THE ALKALI METALS.*

By **LEROY W. McCAY,**
ASSISTANT PROFESSOR OF CHEMISTRY.

A large number of experiments have convinced me that the formation of the

alkali sulpharsenates by treating the corresponding oxygen salts with sulphuretted hydrogen is by no means as simple and satisfactory a method as the statements of Berzelius would lead one to imagine.

The results of twelve specially chosen and carefully conducted experiments prove conclusively that great care is necessary to avoid during the formation of the sulphosalts the simultaneous production of a number of by-products.

The key to the entire mystery of the formation of these products is to be found in the generation, decomposition and even permanence, in dilute solution, of potassium sulphyarseniate.

When the solutions of the several oxygen salts are not too concentrated, and are kept saturated with sulphuretted hydrogen for a long time, or kept hot and saturated with the gas, for a shorter time, it is possible to replace all the oxygen in the oxy-compounds used with sulphur, and thereby transform them completely into the corresponding sulphosalts. However, the complete transformation is most readily and rapidly accomplished by simply bringing the solutions of the arseniates into bottles, saturating the liquids with sulphuretted hydrogen and heating the well-corked bottles in briskly boiling water baths for one hour. The results obtained by decomposing such sulphosalt solutions with excess of hydrochloric acid, and weighing the sulphide which separates out, prove clearly that the transformation is complete. In the filtrates from these precipitates of pentasulphide of arsenic I have never yet detected a trace of sulphyarsenic acid.

In these two ways alone can the formation of by-products be avoided. When the attempt is made to prepare an alkali sulphosalt by simply permitting sulphuretted hydrogen gas to bubble through a cold solution of one of the alkali ortho-

arseniates for a few hours, some of the alkali sulphyarseniate formed splits up into alkali arsenite and sulphur. The alkali arsenite is partly or wholly changed into sulpharsenite by the sulphuretted hydrogen, and since a portion of the sulphyarseniate almost always passes over into sulpharseniate, when the liquid is decomposed with excess of a mineral acid the resulting products are: 1. a precipitate consisting of a mixture of the pentasulphide of arsenic, the trisulphide of arsenic and sulphur, and 2. a filtrate containing sulphyarsenic acid and any undecomposed arseniate.

In this connection I will call attention to the fact that alkali arseniates are transformed first into alkali sulphyarseniates and then into sulpharseniates. The passage is not direct but indirect. I have thus far been unable to obtain the slightest evidence that an arseniate can be transformed by sulphuretted hydrogen into a sulpharseniate without previously passing through the sulphyoxy stage.

I venture to believe that my work upon this matter will serve to clear up a great deal of the obscurity which has thus far been connected with the subject of the complete formation of the alkali sulphyarseniates, by acting upon the corresponding orthoarseniates with sulphuretted hydrogen.

In closing I should like to say that a number of reactions have led me to seriously question the views of Berzelius regarding the action of the alkali hydrates upon the sulphides of arsenic. I hope before long to have something to say on the subject, and in the meantime I beg leave to reserve for myself all right to further investigate the matter.

[Abstract of a paper written for the *American Chemical Journal*.]

THE DOGS OF THE AMERICAN MIOCENE.

By W. B. SCOTT,
PROFESSOR OF GEOLOGY.

The dogs of the North American miocene formations have for the most part been referred to European genera, which, however, a direct comparison with European specimens shows to be erroneous. The White River, or lower miocene, contains two well marked genera, the larger of which has been called by Cope and Leidy *Amphicyon*, on account of the dental formula, which is the same as in that genus. But *Amphicyon* is already tending strongly in the direction of the bears, as is shown by many features of the dentition and the feet, which, so far as is at present known, is not at all true of the American form. For this form, therefore, Leidy's original name, *Daphenus*, must be revived. *Daphenus* is the most primitive of the American Canidae, and is apparently but slightly removed from the Bridger creodont genus *Miacis*. The strong and high sagittal crest, the powerful zygomatic arches, the long, narrow and low cranium, and the very short face are all just what we should expect to find in the ancestral dog-type. The genus has two distinctly marked species in the White River beds, *D. vetus*, and *D. hartshornianus*; the first named is characterized by larger size, the greater proportionate development of the upper molars and by the tendency which the heel of the lower sectorial shows to become cutting. The second species retains the basin-like talon on the inferior sectorial. A third and much smaller species, *D. cuspigerus*, is found in the John Day beds, after which the genus disappears.

The second canine genus of the White River may be called *Hesperocyon*; it has been referred by Leidy to *Amphicyon*, and by Cope to *Galeocynus*, but is really quite distinct from either. The skull of these

little animals has the primitive short face and long cranium, but the brain case is proportionately much more rounded and capacious and the sagittal crest is very weak. The dentition is reduced by the loss of the third upper molar and the diminution in size of the first and second. The skeleton is very little like that of the existing dogs, while the long back, short limbs and weakly developed pentadactyl feet gave it an appearance much like that of the fisher. *Hesperocyon* becomes extremely abundant in the John Day beds, but does not pass up in the higher miocene. Its nearest European allies are *Cynodon* and *Cynodictis*. It probably is not ancestral to any existing forms of dogs, though it may possibly stand in such relation to some of the mustelins.

A curious side branch of the canine stem is the John Day genus *Tennocyon* of Cope. These were for the most part very large dogs with formidable teeth. The talon of the inferior sectorial is trenchant, as is also the crown of the second lower molar; the third is absent. The feet are all pentadactyl. Under the name of *T. coryphæus*, Cope has referred to this genus a species which deserves to be raised to a separate genus, *Mesocyon*, an important member of the ancestry of the true Canidæ, which *Tennocyon* certainly is not. *Mesocyon* has the basin-heeled lower sectorial and the tubercular inferior molars of the dogs, and is in all respects what a primitive member of that family should be. It seems to be the direct successor in time of the *Daphænus hartshornianus* as *Tennocyon* is of *D. vetus*.

The John Day also has yielded two other curious genera of dogs, *Enhydrocyon* and *Oligobunis*, but these are not important for our present purpose.

The study of the canine series is especially instructive as showing the steps of evolution of the carnivorous skull. The factors which have determined this de-

velopment are, (1) brain growth; (2) the development of the olfactory chamber; (3) the changes in the number, character and size of the teeth; (4) the requirements of muscular attachments. Of less fundamental importance are the changes which take place in the relative development of the eye and ear. The primitive carnivorous skull as seen in the earliest members of that order and in the unspecialized creodonts, has many features in common with the skull of the primitive ungulates. The face is short and the orbit placed very far forward; the cranium is long and narrow and low, but the region which contains the cerebral hemispheres is relatively short, the length of the cranium being given by the great proportional length of the olfactory lobes and the hind-brain; the sagittal crest is very high and strong and the zygomatic arches very long and massive. The teeth are not reduced in number, but are relatively small and closely crowded together. From this primitive condition the evolution of the skull characteristic of the modern dogs may be traced step by step. The brain, and especially the cerebral hemispheres, become steadily larger and more rounded, overlapping the olfactory lobes in front and the optic lobes behind, so that the post-orbital constriction is brought much nearer to the orbits and the frontals extend over the roof of the cranium at the expense of the parietals. Coincidentally with this the sagittal crest becomes less and less prominent and in many of the smaller dogs disappears and is replaced by a lyrate area. The crest, other things being equal, may be said to vary inversely as the capacity of the cranium, for with an undeveloped brain-case there is necessary a high and massive crest for the attachment of the temporal muscles, but with the large surface offered by a full and well rounded brain-case, the crest may be reduced without diminishing the surfaces of attach-

ment. Similarly the enlargement of the size of the teeth must be followed by one of two consequences, either their number must be diminished, or the face must be lengthened, the latter process having been adopted in the dogs.

The paleontological series clearly shows that the cranial and facial proportions seen in young animals cannot have the phylogenetic importance which has been attributed to them by Huxley and others, because the disproportionately large size of the brain which is characteristic of all foetal and new born mammals, almost entirely masks the ancestral characters. An example of this is the absence of the sagittal crest in young mammals and its invariable presence in the early representatives of all the groups of the class.

SUMMARIES OF PAPERS READ BEFORE SCIENTIFIC SOCIETIES.

BALLOT AND ELECTORAL REFORM.

By R. O. AULICK,
UNIVERSITY FELLOW IN POLITICAL SCIENCE.

This paper does not profess to embody any discussion of particular methods, but rather to consider such general measures as must enter into any satisfactory system of reform. The enactment of penal statutes has always been found to fail as a remedy for corrupt practices or abuses. The only satisfactory method is to ensure their detection, to make them unprofitable, or to render them impossible.

To this end, any efficient system of reform must embody the following measures:

1. Compulsory secrecy in voting.
2. Ballots officially printed and distributed, containing the names of all candidates.
3. A strict form of registration.
4. Some method of open nominations.

5. Penalties of great severity for all violations of the several provisions, and all attempts at corruption.

1. Compulsory secrecy in voting is absolutely necessary to remove the individual from the power of those improper influences which appeal most directly to his interests, and which depend for their operation upon a knowledge of the voter's action. Bribery and all forms of corruption, and intimidation, become at least unprofitable and unsatisfactory, if not impossible, when the only guarantee is the word of the voter influenced.

2. Official ballots would serve to check corruption by destroying one principal item of expense in elections—the private printing and circulation of the ballots, which serves as an excuse for large expenditure and a cloak to corruption. Official ballots are as essential to a complete system of reform as compulsory secrecy, for they would be the most efficient remedy for the monstrous evils of “stuffing the ballot box” and “counting out.”

3. A registration law strict in its provisions and properly enforced, is the only remedy for the prevalent evil of *illegal voting*. This consists in “repeating,” or voting more than once; voting by unqualified individuals; and voting by individuals not legally resident in the particular election district. Registration should be public, each individual on entering his name receiving a certificate of registration. The lists for each district, when complete, should be published and open to challenge. At the subsequent polling none but those on the registry list and having a certificate of registration should be permitted to vote.

4. In order to secure independent voting, to free the voter from the power of “machines” and “bosses,” it is necessary that he should be able to cast his vote for a candidate of his own. As the mere right of voting for a candidate not named on

the ballot is ineffectual (because unorganized individual action will never offset the effect of concerted party action in convention), it should be in the power of a number of the voters in any district, proportional to the size of the district, to nominate a candidate of their own, with the certainty of having his name on election day presented to the people on equal terms with those regularly nominated.

5. The operation of no human law, however perfect, is efficient or satisfactory when those to whom its execution is entrusted are negligent or corrupt. Therefore it is essential that the severest penalties be enacted, and inflicted upon every one, whether an official or a private individual, at all connected with corrupt practices.

Although such a reform would be complete in itself, and if consummated, might readily determine further action, it should be regarded but as the forerunner of broader and more radical measures. In a kindred though independent branch of our political system there exist many evils and abuses which, under the present circumstances, cannot be satisfactorily met. A thorough reform of the ballot system is a necessary initial measure to grappling with these problems. They include the question of the presidential election, of the control of elections and of the franchise.

The necessary reforms involve

1. The abolition of the electoral college and the election of the President and Vice President by direct popular vote.

2. Federal supervision of all national elections.

3. Federal control of all suffrage qualifications.

1. Although at first the President was supposed to represent the sovereignty of the *states* as well as of the *people*, and was therefore chosen by *electors* elected by the people of each state as state officials, to-

day he has practically ceased to represent the *states* at all. He is voted for by each individual voter as the candidate and representative of a *national* party, without any thought of the character or functions of the middle man. The President is voted for by the people as a whole and is to-day the most popular ruler in the world. The only result of retaining the elector or electoral votes is to nullify the votes of great masses of the people, if not of whole sections of the country. As the number of electoral votes which a state possesses equals the number of Representatives and Senators which she sends to Congress, the number in some states is large. Certain single states are thus alone able to offset the combined votes of several states. As the states which possess the greatest number of electoral votes are generally close states or doubtful states, the majority either way being small, it follows that not alone are the votes of the minority in such states counted as nothing, but the *majority* votes in the other states, whose combined electoral votes are offset by the electoral votes of the larger states, are likewise nullified. So not alone is the will of a large body of the people disregarded, but the votes of the individual voters in the several states are not as they should be, equal, but the vote of one man is, in some states, of greater power than the vote of several in other states. The remedy is to have the President and Vice President elected by direct popular vote as are the governors in the several states, the vote being for the ticket as a unit, and disregarding state lines altogether.

2. Federal supervision of these elections would follow as a natural consequence of the preceding measures. The elections in such an event would cease to be *state* elections in any sense, and would naturally pass from state control. Federal supervision of these elections would, however, involve no more than is at present

involved in the control of elections of Representatives.

3. Federal control of the suffrage is essential, in order that there may be uniformity of qualifications throughout the country, which there is not at present, and that the states may be restrained from granting the privilege of voting to resident aliens. This is a very questionable and inexpedient exercise of power, if it is not an altogether unwarrantable assumption, which is at least an open question. If the reform of these abuses be left as at present in state hands, no uniform measures will ever be taken. The remedy lies in the general requirement of some special qualifications, and these must be either

1. A property qualification, or

2. An educational qualification.

The choice between the two is a question of expediency and must be determined by circumstances. Such are the changes and reforms which sooner or later the well being of the nation will demand.

[Abstract of Paper read at a meeting of the Philological Society.]

THE DISTRIBUTION OF GREEK TEMPLES.

By GEORGE B. HUSSEY, Ph. D.,
FELLOW IN ARCHAEOLOGY.

Most of the Greek temples are known to us only by the fact that they existed, and this slight information is conveyed in notices widely scattered through the whole volume of Greek literature. No attempt is here made to collect all of them; but an average has been sought by examining certain representative sources: (1) geographers, especially Strabo and Pausanias; (2) historians (Herodotus, Polybius, Diodorus); and (3) inscriptions, many of which contain a clause directing that they shall be set up in some shrine where they would be more secure.

These sources give some 1300 temples and shrines—a number quite sufficient to

show how temples were distributed among the various deities; and, secondly, though with less certainty, how they were apportioned among the towns of Greece.

Apollon stands at the head of all, and Artemis and he together have more temples than any other three gods. After Apollon and Artemis comes Athena and then Zeus. Although the nominal chief of the gods he stands fourth in number of shrines, while Hera, his queen, occupies the tenth place. In the interval between Zeus and Hera come Aphrodite, Demeter, Dionysos, Asclepios, and Poseidon. Such is the order among all the Greeks, and for the first three deities, Apollon, Artemis, and Athena, it is the same for each Greek race. The Dorians, however, raise Asclepios to the fourth place among themselves. The Ionians and Aeolians give Demeter and Dionysos the fifth and sixth places.

Two-thirds of all the temples belong to the twelve greater gods and one-third to the lesser divinities, chief among whom is Apollon's son Asclepios. About the same number of temples belong to goddesses as to gods, but, of the temples belonging to the twelve greater deities, 57 per cent. belong to the six goddesses, 43 to the six gods.

The second point to be considered is whether the number of temples in any place is not some index of its population; and especially in the smaller towns of Greece is it not almost the only clew by which to determine their relative importance? It may be urged that we are not acquainted with the whole number of temples; that they often exist long after most of the inhabitants have left a town. Some temples are situated on mountains or in very secluded spots, and others were sometimes built in obedience to oracles or dreams, and in such cases would not seem to be at all dependent on population.

These objections are all to some extent valid, and though they disturb, they do

not destroy the general relation that exists between the number of temples and the number of people. Probably the number of temples is more strictly related to the population of a town at its most flourishing period, or if it had been burnt or destroyed to the largest size it reached after that catastrophe. The number of temples in the larger cities of each Greek state is as follows: Sparta, 84; Athens, 71; Argos, 36; Megalopolis, 32; and then in order Megara, Sicyon, Hermione, Patrai, Tegea, Corinth, Troizen, Olympia, Thebes, and Mantinea. Thebes and Corinth in the time to which our notices of temples mostly belong (100 B. C.—100 A. D.) were just rising from a state of ruins, and Athens had suffered great reverses. Strabo, in speaking of the Peloponnesos, places Argos next after Sparta. Megalopolis he considers the largest city in Arcadia and next after it came Tegea, but Mantinea was then falling in decay.

Among the Greek islands Sicily has the most temples and after it comes Crete, Rhodes, Euboea, Delos, Lesbos, Samos. Smyrna leads in the cities of Asia Minor, and next to it comes Pergamon, followed by Cyzicos, Halicarnassos, Mylasa, Miletos, Teos, Erythrai. Although stress ought not to be laid on the exact number of temples, it may be safely concluded that their distribution throws some light on the movements of population which took place in Greece after the death of Alexander.

[Abstract of paper read before the Philosophical Society, January, 1890.]

SUMMARIES OF PAPERS PUBLISHED.

ABSTRACT OF NOTE IN PRESBYTERIAN AND REFORMED REVIEW, JANUARY, 1890, ON "THE FOURTEENTH YEAR OF KING HEZEKIAH."

By JOHN D. DAVIS,
PROFESSOR OF HEBREW IN THE THEOLOGICAL SEMINARY.

"In the fourteenth year of King Hezekiah did Sennacherib King of Assyria

come up against all the fenced cities of Judah and took them" (2 Kg. 18:13; Is. 36:1.). Among the monumental records of King Sargon is a tablet known as the Nimroud inscription. The Assyrian King there styles himself the "subjugator of Judea."

From abundant internal and external evidence, it is clear that this tablet was composed before the close of the year 714, B. C. Between the years 722, when Sargon ascended the throne, and 714, there are three occasions when the Assyrian army was in the neighborhood of Judea; namely, at the fall of Samaria in 722, again during the expedition against Gaza in 720, and still again in 715 at the time of the transportation of Arab tribes to Samaria and the reception of tribute from Arab rulers and from Pharaoh of Egypt. The Judean expedition did not take place in connection with the capture of Samaria; for, though this event is described in the Hebrew records and also and with more detail in the Assyrian annals, yet in neither is there any mention of Judea. The usurper Sargon had too much to do in strengthening his throne to have time for expeditions into regions beyond. The most suitable place for the subjugation of Judea is, therefore, in connection with the expedition of either 720 or 715 and, so far as the Assyrian monuments are concerned, there is no choice between these two dates.

Some data may be obtained from the Hebrew records. The prophet Isaiah represents the Assyrian monarch as saying, "Is not Calno as Carchemish, Hamath as Arpad, Samaria as Damascus? As I have done to Samaria, shall I not so do to Jerusalem?" Unless the prophet is speaking from his "watch tower," which is not probable, Samaria had already fallen. It yielded to Sargon in 722; and of the other cities mentioned, some of which had been at times subject to former Assyrian kings, Sargon captured Hamath in his second

year, and took Arpad and Damascus and made a signal example of Carchemish in his fifth year. In this proclamation of Isaiah concerning Assyria, an attack upon Jerusalem is represented as meditated. The Assyrian army, therefore, did not advance against Judah and Jerusalem until after the fall of Samaria in 722. and probably not until after Sargon's fifth year, *i. e.*, 717. Another independent datum is that at the time of his sickness, which according to the Bible occurred in his fourteenth year, *i. e.*, in 714, B.C., Hezekiah was in fear of an Assyrian attack on Jerusalem. The king may have entertained mere general apprehension, quickened perhaps by prophetic utterance, lest the Assyrian potentate who had recently overthrown Samaria would eventually turn his attention to Judea; or his fear for the capital may have been due to the presence of an Assyrian army within the borders of his kingdom. At any rate in the year 714, Hezekiah was in dread of an Assyrian march against Jerusalem.

Placing Assyrian and Hebrew records side by side, the monuments testify to an Assyrian subjugation of Judea before the close of 714, and suggest its connection with either the year 720 or 715; while the Hebrew records both indirectly and directly (2 Kg. 18: 13) point to the year 714 as the date. Chronological harmony will be at once established if, in connection with the fact that an Assyrian army was in the immediate vicinity of Judea in 715 receiving tribute from Pharaoh of Egypt and several Arab princes and engaged in that year in the transportation of Arab tribes, it be assumed that, the aforementioned work having been accomplished, the Assyrian troops were led into Judea in the beginning of 714.

The paragraph comprised within 2 Kg. 18: 14 and 19: 36, narrates in detail the great fruitless Assyrian expedition of Hezekiah's twenty-seventh year so far as it con-

cerned Jerusalem: verse 13 forms the introduction to this history, describing the prior invasion; just as 19: 37, relating to an event which happened twenty years later, forms the conclusion of the story. Thus is presented in one sketch the entire history of Assyrian operations against Hezekiah, from their incipency to their inglorious end.

But Sargon was king of Assyria in Hezekiah's fourteenth year, whereas the Hebrew writers state that it was Sennacherib who then invaded Judea. Yea, verily: nevertheless Sargon, on the express testimony of the monuments, did not conduct all his campaigns in person; and, moreover, during these very years 715 and 714 the main warfare of Assyria was with nations to the north and far east of Nineveh, so that it is quite probable that the expedition into the remote southwest and on business of minor importance was entrusted to a general of the army. Sennacherib, the son and successor of Sargon, occupied one of the highest military positions in the government: he is expressly called a *rab-shaku*, an official who was often entrusted with military expeditions; and even before the year 714 he received letters from the various Assyrian army officers, engaged in warfare in different parts of the world, and drew up therefrom reports for his royal father. That this active *rab-shaku* should have conducted the expedition against Judea is quite credible. That he is called by the Hebrew annalist, writing after Sennacherib's accession to the throne, "King of Assyria," is simple prolepsis.

*SINGULAR SOLUTIONS OF ORDINARY
DIFFERENTIAL EQUATIONS.*

By H. B. FINE,
PROFESSOR OF MATHEMATICS.

In this paper the methods used by Briot and Bouquet in the study of ordi-

nary solutions of differential equations (*Journal de l'Ecole Polytechnique*, cah. 36,) are applied to an investigation of the properties of singular solutions and the conditions of their occurrence.

The earlier work on singular solutions—that of Taylor, Clairaut, Euler, Laplace, Lagrange, Legendre, Poisson, Cauchy,—rests on the assumption that the ordinary solution—the complete primitive, as it is called—of every differential equation of the first order, $f\left(x, y, \frac{dy}{dx}\right)=0$, is a single, definite function— $\phi(x, y, a)=0$ —of x, y , and an arbitrary constant or parameter, a .

The equation $\phi(x, y, a)=0$ defines, when all possible values are given to a , a system of curves which, speaking generally, will have an envelope. This envelope is a *singular solution* of the differential equation $f=0$, in that it satisfies $f=0$, but is not included in the proper solution, $\phi=0$.

But this assumption regarding the character of the complete primitive is altogether unwarrantable and, as Darboux has pointed out, (*Comptes rendus*, t. 71,) leads to the direct contradiction that equations which from their own form clearly do not have singular solutions, must have such solutions from this supposed form of their complete primitive. It is anything, therefore, but a proper starting point for a rigorous investigation of singular solutions.

A differential equation of the first order defines a system of curves, one or more of which pass through any given point, x_0, y_0 . But *all* that the equation gives by which to define these curves are infinite series, expressing the y of a curve point in integral powers of its x and with coefficients which are functions of x_0, y_0 . Any investigation of singular solutions which seeks to be fundamental or rigorous, or to fix the place of the singular solution in the entire system of solutions, must rest on this conception of the solution of a

differential equation. It must discover what conditions the coefficients of one of these series satisfies when it represents a singular instead of an ordinary solution.

Briot and Bouquet have shown that all ordinary solutions of the equation

$f\left(x, y, \frac{dy}{dx}\right)=0$, which pass through a given point, x_0, y_0 , and there have a common value, $\left(\frac{dy}{dx}\right)_o$, of $\frac{dy}{dx}$, may by suitable

transformations be reduced to the form $y=Vx^m$; where V is a determinate function of v and x , and v is connected with x by a differential equation of the form $x \frac{dv}{dx} = \phi(v, x)$.

In the first section of this paper it is proven that if $f\left(x, y, \frac{dy}{dx}\right)=0$ have a sin-

gular solution and x_0, y_0 lie upon it, among the functions V determined by the Briot-Bouquet method, will be one which corresponds to this solution, but that the accompanying differential equation between v and x will degenerate into an equation of the form $\psi(v, x)x \frac{dv}{dx} = \psi(v, x)\chi(v, x)$

and be satisfied by $\psi(v, x)=0$ only. From $\psi(v, x)=0$ a series can be derived for v in powers of x , and from this, in its turn, by substitution in $y=Vx^m$, the series for y in powers of x which defines the singular solution.

The differential equation $\psi x \frac{dv}{dx} = \psi x$ brings out the relation of the singular solution to its differential equation with great clearness. In the strict sense, it is not contained in the solution of the equation any more than any arbitrary function, $\phi=0$, is contained in the solution of $\phi \frac{dy}{dx} = \phi\psi$. Yet it takes the place of one of the two proper solutions ordinarily occurring for values, x_0, y_0 , of x, y , which

satisfy the two equations $f = 0, \frac{df}{d(\frac{dy}{dx})} = 0$

In the second and principal section of the paper, the theory developed in the first is extended to equations of higher orders.

The third section contains a discussion of the singular solutions of those differential equations of the n^{th} order whose general solution is obtainable in the form $\phi(x, y, a, \beta, \dots v) = 0$, algebraic in $a, \beta, \dots v$ —with special reference to the geometrical interpretation of the equation which, algebraically speaking, contains the singular solution.

[Abstract of a paper published in the *American Journal of Mathematics*, XII, 4.]

THE ORGAN OF BOJANUS OF THE FRESH-WATER MUSSEL.

By WALTER M. RANKIN,
INSTRUCTOR IN BIOLOGY.

The following is an abstract of a paper presented as the Inaugural Dissertation for the degree of Doctor of Philosophy in the University of Munich.

The organ of Bojanus, which is the renal organ of the Mussel, is shown to be a paired structure; each lateral division consisting of two limbs, one above the other, which communicate at the posterior end by means of a complicated series of chambers. The two upper limbs are, for a short distance at the anterior end, in communication; besides this there is no union of the two halves of the organ, but they are separated throughout their whole length by the Sinus Venosus which runs between them. The organ communicates by paired openings, on the one hand with the pericardial chamber, on the other with the exterior. The passages into the pericardial cavity are short, muscular walled tubes—the “pericardial funnels.” These open into the anterior end of the

lower limbs. The upper limbs, near their anterior end, open downward through tubes—the ureters—into the space between the lamellæ of the inner gills.

Microscopical study shows that the walls of the organ are made up of a basement membrane of structureless connective tissue, in which are scattered band-formed and stellate cells. The walls of the lower limb and posterior coil are folded, while the upper limb is smooth. Among the connective tissue cells are a few muscle fibres, and nerves are distributed to the organ which arise from the cerebro-visceral commissures and the visceral ganglia. Lining the whole of the lumen of the organ is a single layer of epithelial cells. These are throughout (with the exception of the pericardial funnels and ureters) irregular cuboid secreting cells. In them are found urinary excretions, and they are provided with irregularly scattered flagelliform cilia. The walls of the funnels and ureters are covered with thickly set cilia, by means of which a current from the pericardium to the exterior is caused. In addition to these short cilia is an unusually long form of cilia at the renal end of the funnels. Besides the ciliated cells are a few cells modified into nerve terminations—“penicil cells”—and many large one-celled mucous glands.

The organ is now generally conceded to be renal in its function and may be compared to the segmental organs of the Annelid. The pericardial, or ciliated, funnel corresponds to the inner ciliated opening; the lower limb and posterior coil to the more or less coiled glandular portion; the upper limb and ureter to the wider, muscular walled tube in the annelid which opens outward. In the mollusk, the upper limb is similar in its function to the lower limb.

In regard to the function of taking-in of water with which this organ has some-

times been credited, it is highly improbable that it has any such role. It is shown in the paper that, by means of reservoirs for the blood and a nice adjustment of valves in the arteries and sinus venosus, the swelling of the foot may be accounted for without the introduction of an extra supply of fluid from without the animal.

[Published in the *Jenaische Zeitschrift*, Bd. XXIV, N. F. XVII.]

THE MAMMALIA OF THE UINTA FORMATION.

I. THE GEOLOGICAL AND FAUNAL RELATIONS OF THE UINTA FORMATION. II. THE CREODONTA, RODENTIA AND ARTIODACTYLA, BY WILLIAM B. SCOTT. III. THE PERISSODACTYLA. IV. THE EVOLUTION OF THE UNGULATE FOOT, BY HENRY FAIRFIELD OSBORN. TRANSACTIONS OF THE AMERICAN PHILOSOPHICAL SOCIETY, NEW SERIES, VOL. XVI, PART III. 90 PP. 4TO. 5 PLATES.

This is the third memoir based upon the extensive collections of Tertiary Fossils in the E. M. Museum of Geology and Archaeology. While the two earlier memoirs were devoted to special mammalian orders, the Dinocerata and Creodonta, this is descriptive of the uppermost Eocene fauna which has hitherto been known only from brief notices of the more abundant forms. The Uinta is the most inaccessible of all the Eocene horizons on account of the absolutely desert nature of the country, the intense heat of the summer months, and the hostility of the White River Utes. The expedition of members of the class of '86 under the leadership of Francis Speir, Jr., '77, encountered great difficulties in exploring this country, and deserve a hearty recognition of their perseverance and energy.

The collection, as compared with those from the underlying Bridger, is a small one but embraces an unusual proportion of very characteristic types. Dr. Hill has shown his usual skill in preparing and mounting the specimens for examination. Seventy pencil drawings have been made with great care by Mr. Rudolph Weber, from which Werner & Winter, Frankfurt a. M., have executed five lithographic plates. The American Philosophical Society of Philadelphia has been very liberal in the matter of publishing.

The chief interest which attaches to these Uinta mammals arises from the relation which they hold to the middle Eocene mammalia on one side and to those of the lower Miocene on the other. They afford abundant proof that the Uinta Lake of North Eastern Utah was the last of the series of Eocene lake basins of which we have any evidence and show that the age of these beds is nearly continuous with that of the Miocene of the White River, Nebraska. It is not a mixed but a pure transition fauna and chiefly transition types have been thus far discovered. There are also a few types which apparently represent the last survivors of families abundant in the Eocene and one type, *Leptotragulus*, which is the forerunner of a new line of Miocene forms. One of the most perfect transition forms is *Protoreodon*; this is fully described by Dr. Scott, as the ancestor of the lower Miocene *Oreodon*: "This relationship is made clear by a comparison of the skull, the teeth and the feet, where the differences which *Protoreodon* exhibits from its Miocene successor are just those tendencies towards simplification that we should naturally expect to find in the ancestral type." *Leptotragulus*, another artiodactyl, is regarded as the earliest known representative of the line which led to the camels; this also has

close relations with some of the Eocene forms.

Turning to the odd-toed ungulates we find the horse-line represented by the feet and teeth of the graceful little *Ephippus*. The rhinoceros main or side line is represented by *Amynodon*, of which portions of the skull and a fine series of teeth are in the collection. The largest form, of which the skeleton is fully described for the first time, is *Diplacodon*. Perhaps the most important fact in this part of the subject is the identification of *Isectolaphus* as a true ancestor of the Tapir. Other mammals represented are lemuroids, and rodents. There is also a single genus belonging to the Creodonts, the Carnivora of the Eocene period.

The last section of the paper by Dr. Osborn is devoted to a study of the evolution of the fore and hind feet of the ungulata in its bearing upon the probable structure of the primitive foot, upon the classification of the ungulates and the problems of foot mechanics. The conclusions reached are in many respects directly opposed to those advanced by Cope.

AN ACCOUNT OF THE PROGRESS IN VULCANOLOGY AND SEISMOLOGY IN THE YEAR 1886. By C. G. Rockwood, Jr.

This pamphlet, from the advance sheets of the Smithsonian Report for 1886-87 was prepared early in 1887, but has only recently issued from the Government press in Washington. It forms a pamphlet of twenty-four pages, of which sixteen are devoted to a resumé of the work done in these departments of science, the remaining eight pages being occupied by the bibliography of the year, containing over two hundred titles. Its subject matter is arranged under the following heads:

VULCANOLOGY.—Volcanic phenomena of 1886, volcanic phenomena of previous years, causes of volcanic action.

SEISMOLOGY.—Earthquakes of 1886, earthquake lists of 1885, catalogues of earthquakes of previous years, study of earthquakes.

SEISMOMETRY.—Instrumental records, instruments.

It includes condensed accounts of the New Zealand eruption of June 10th, 1886, of the changes in the Hawaiian volcano of Kilauea, and of the Charleston earthquake of August 31st, 1886; with reviews of the earthquake lists published by Fuchs, Rockwood, Detaille, O'Reilly and Boehmer. There are also notices of the Transactions of the Seismological Society of Japan, of Milnes' Earthquakes, and of many articles in the various English, French and German scientific journals.

PROGRESS IN GEOGRAPHY AND EXPLORATION IN 1886: By William Libbey, Jr.; from the Smithsonian Report for 1886-87.

This report like the one above referred to has just appeared, though written three years ago. In it a resumé is given of the principal explorations in the different continents and the results obtained as far as possible. Of course it is impossible to give in the limited space of 13 pages anything more than the bare outline of what has been done, but enough is given to furnish a clear idea of the progress made in the newly acquired knowledge of the various parts of the world. Europe seems to have been properly retired from the list of continents which are subjects for exploration, but the exploitation of its resources are in the full flush of development. Here the history of man's modifying effect upon nature has but fairly begun to be written.

Asia and Africa appear to have received the most attention this year, although there is no lack of expeditions of note in all the quarters of the globe.

It would add very materially to the value of such reports if they could be published in a more timely manner, so

that the results thus recorded would have a little less the appearance of ancient history.

REVIEW OF BOOKS.

PROFESSOR WEST'S EDITION OF THE PHILOBIBLON.

With the appearance of the third volume of the Philobiblon, Professor West completes the work he undertook three years ago upon the invitation of the Grolier Club of New York City. The length of time spent upon his task is justified by the manner of its accomplishment. The Grolier Club has testified to this by its recent action in electing the editor of the Philobiblon their first honorary member.

Volume I contains the Latin text with marginal notes showing the various readings in the four principal manuscripts upon which, in the main, the text is founded. The editor's *Monitum*, quite in de Bury's style, is followed by the author's *Prologus* and the twenty chapters of the treatise on the love of books. This is not the place in which to speak of the contents of these chapters. The volume closes with the colophon, which in manuscripts and the earliest printed books takes the place of the more modern title page.

Volume II contains Professor West's translation. In this he has succeeded in retaining the mediæval tone of the original Latin, while rendering it in clear and forcible English. In some instances the difficulties of an easy translation are apparent, but for this the author and not the editor is responsible. The Latin in certain parts is far from classic and does not readily lend itself to transfer into classic English. Professor West has certainly chosen the right course in not hiding the peculiarities of de Bury's style under a free translation, in not rendering the Latin

of de Bury as if it were the Latin of Cicero. And the editor's English is not quite the English of to-day, but has, purposely, as he tells us in the preface of volume III, "reminiscences of the richer style found in writers like Thomas Browne and Francis Bacon."

Volume III is Professor West's own book. It contains an account of the times in which Richard de Bury lived, of his life, his character and attainments, and his book. There then follows a full description of the material upon which the text of this edition is founded. This is the most important part of the volume. Traveling backwards we are first informed about the various printed editions, beginning with the *editio princeps* of Cologne, 1473, and ending with Morley's recent London reprint of Inglis's translation in 1888. Facsimile pages of the Cologne and of the Spires, 1483, editions are given. All the printed editions were found to be much corrupted, owing to the fact that they were descendants of the first Cologne edition which was printed from a corrupt manuscript. A careful study of the manuscripts disclosed this fact. Twenty-five of these Professor West personally examined, and he obtained full accounts from trustworthy sources of nearly all the remaining ten that are accessible. Four of those examined were found to be so superior to the others that the true text was taken from them with some help from later manuscripts. Two of the four belong to the fourteenth century, and the other two to the first half of the fifteenth. A facsimile page of the third [C] is given. A general view of the manuscripts is shown in tabulated form. The description of the MSS. is followed by explanatory notes of difficult words and phrases in the Latin text, and these by an indication of all the references to the Vulgate found in the text, numbering about three hundred and fifty, and coming from more than fifty different

books of the Bible. The volume closes with appendices consisting of brief critical discussions of Adam of Murimuth's Chronicle, Mr. Thomas's Edition of the Philobiblon, Prof. Morley and the Philobiblon; with notes on DeBury as a Book-Collector, his seals, copies of early editions, and an account of the typography of this edition, written by Mr. De Vinne of New York, from whose press it was issued. The three volumes constitute a beautiful example of the art of printing, the first in particular with its black-letter type, gilded initials and brilliant rubrication. The third is adorned with exquisitely engraved reproductions of Richard de Bury's seals, the episcopal seal forming the frontispiece.

GOETHE'S SESENHEIM, edited with an introduction and notes, by H. C. O. Huss, Ph.D., Professor of Modern Languages and Literature in the College of New Jersey, Princeton. Boston. D. C. Heath & Co., 1889.

To have conceived of lifting out of the "Dichtung und Wahrheit" its brightest episode and of presenting it in a separate form, is a service for which teachers and students of German will be extremely grateful to Dr. Huss. It is not always that editors are happy in their choice of German prose for class-room work. The tendency is to print puerilities, in trying to avoid length or difficulty or inappropriateness of various kinds. The Sesenheim episode is an important literary "document," from its biographical nature; but it is so much more—it is interesting, it is enchanting! What of it is veritable and what is due to the alchemy of time in a generous old age, is a question apart. The important thing is that few love-stories, if any, are more touching than this tale of how the great poet, in his student-days at Strasburg, went across the level, bounteous Alsatian plain and wood

the pastor's daughter. The summer glow that pervades this quiet story, the perfect limpidity of its style, make the reader forget how mature are the point of view and the reflections of the master who here summons back the sunniest days of his youth. It is easy to overlook the supreme art with which the figure of Friedrike is detailed and made to illuminate these pages, as she once illumined for Goethe her home and country-side.

In a brief but comprehensive introduction Dr. Huss leads up to the Strasburg days and the first visit to Sesenheim; and before you are aware you are on the pillion behind young Goethe, riding across the Rhine meadows on what proved a fateful journey for two hearts. You feel at the end, too, that Dr. Huss is no more than just in giving a few pages of the self-condemnation which Goethe passed upon himself for ever having been happy after leaving Friedrike, whether wisely or not, to pine for his return. He deserved the flagellation, yet what hand but his own would have dared give it! Dr. Huss's notes are just what is necessary to the comprehension of a few allusions and the more difficult idioms that occur. These, with a clear open type, and the eternal interest of the story, will doubtless make "Sesenheim" welcome wherever it goes.

STUDIES IN LITERATURE AND STYLE. By Theodore W. Hunt, Ph.D., Professor of English Philology and Discourse in Princeton College, I. Vol. pp. xiv and 303. A. C. Armstrong & Son. New York, 1890.

This volume by Professor Hunt is intended to complete a series of which his previously published works on "The Principles of Written Discourse" and "English Prose and Prose Writers" are parts. The object of the present volume, as stated in the preface, is "to state,

discuss and exemplify the representative types of style with primary reference to the needs of the English literary student." The author regards style as an index of the thought and personality of the writer, and an expression of the underlying substance of literature, in vital connection with which it must be studied.

The introductory chapter is a forcible plea for "Literary Studies," their claims being rested not simply on the aesthetic pleasure they afford, but primarily on their importance as sources of knowledge and means of culture and discipline.

The four following chapters are devoted to the discussion and illustration of four representative styles, the Intellectual, the Literary, the Impassioned and the Popular. These are first considered analytically as distinct types and then synthetically as elements in the concrete forms of literary expression. The style of an author may be characterized as Intellectual, Literary, etc., in accordance with its dominant element.

The next four chapters treat of the stylistic qualities of Critical, Poetic, Satiric and Humorous literature. The close relation of style to matter is here illustrated in the fact that the discussions are equally meritorious whether considered from the standpoint of form or from that of underlying substance. The truth is, as the author constantly insists, that style can be adequately treated only in the concrete as the outward expression of an inner spirit.

The two following chapters discuss the English styles of Matthew Arnold and Emerson, and envince the author's catholic appreciation of two very distinct modes of literary expression. The estimate of Arnold is on the whole discriminating and just. That of Emerson dis-

plays both insight and appreciation. The formal defects of Emerson's style, which are recognized, do not blind the author to his essential merits. He regards the appreciative perusal of Emerson as "an education and an inspiration, quickening into new activity what Emerson calls, in speaking of Milton, 'the vibration of hope, self-reverence, piety and beauty.'"

The concluding chapter on "Independent Literary Judgments" contains a careful and judicious discussion of the province of independent judgment in literature and the qualifications necessary to entitle the critic to a hearing. The literary critic must be a student and a scholar who has acquired the right to speak by his mastery over his subject. He must be an intelligent critic, able to give a reason for the faith that is in him, and he must come to the discharge of his task with an unbiased mind and a spirit of modest reserve. The closing paragraph insists on the supreme demand in this age of servility, for sturdy independence in the sphere of literary criticism.

An interesting feature of the volume are the selections given at the close of each chapter illustrating the theme or the author under discussion.

Professor Hunt's book is a valuable contribution to a department of authorship in which he is a recognized master. It presents those features of accurate and extensive scholarship, philosophical grasp, logical arrangement and solidity and finish of literary style which those who know the author would naturally expect to find. The volume will not only interest and instruct the general reader, but will also serve as an efficient and reliable guide to the special student of literature.



OBSERVATORY BUILDING.



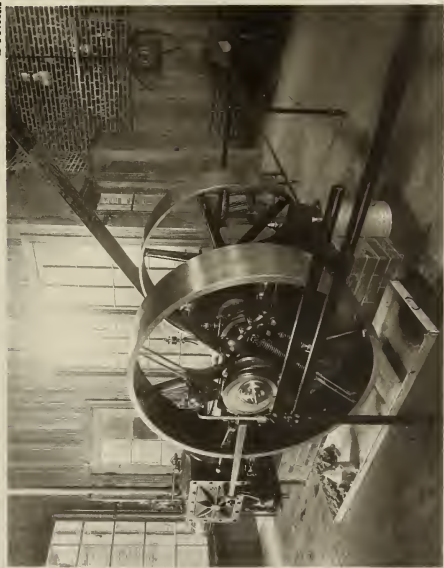
READING ROOM.



MAIN LABORATORY.
MAGNETIC OBSERVATORY, DEPARTMENT OF ELECTRICAL ENGINEERING.



DYNAMO BUILDING



ENGINE.



DYNAMOS.
DYNAMO BUILDING, DEPARTMENT OF ELECTRICAL ENGINEERING.

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. II.

JUNE, 1890.

No. 3.

THE SCHOOL OF ELECTRICAL ENGINEERING.

The course of Electrical Engineering is designed to furnish instruction in the theory of electricity and in its application in the arts and industries. The especial course of study in electricity occupies two years. The John C. Green School of Science furnishes a course in mathematics, physics and modern languages which is especially arranged to meet the requirements for entrance on this course.

PRELIMINARY COURSE.—The requirements for entrance are the same as those of the Department of Civil Engineering, and the studies pursued in it are, in the main, the same as those of that department. They embrace mathematics to the completion of the calculus, analytical mechanics, mechanical drawing, physics, general and analytical chemistry, geology, astronomy, English language and literature, French and German. This preliminary course is completed at the end of the third year.

REQUIREMENTS FOR ENTRANCE.—Those who have taken this preliminary course are admitted to the course in Electrical Engineering without further examination. Applicants who have not taken this course will not be admitted unless they furnish evidence of suitable preparation in mathematics, physics and general chemistry. These studies are considered essential preliminaries to effective work in the course. If the applicant is deficient in analytical

mechanics, drawing or modern languages, all of which studies are considered essential for the degree of Electrical Engineer, an opportunity will be given him to take suitable courses in those studies in the School of Science.

COURSE OF STUDY:—

First Year:—The mathematical theory of Electricity, Mascart and Joubert's Treatise on Electricity, Vol. 1, with references to Maxwell, Cumming and other authors.

General Electricity, Volume 4 of Wüllner's Experimental Physik.

These courses occupy eight hours a week throughout the year.

Elementary Electrical Measurements, with reference to Stewart and Gee, Kohlrausch, Slingo and Brooker, Gray, etc.

Two days in the week are left free for this work.

Strength of Materials, Mechanism, Theory of Prime Motors, each two hours a week for half the year. These courses are taken with the Senior Class in the Engineering Department.

Second Year:—The theory of Electrical Measurements, Fleming's Alternate Current Transformer. Four hours a week for half the year. Mascart and Joubert's Treatise on Electricity, Vol. 2. Four hours a week for half the year.

Theory of Dynamo Construction, Thompson's Dynamo Electrical Machinery, with collateral lectures.

Technical Applications of Electricity in Telegraphy, Electro-metallurgy and Electro-chemistry, Electric lighting, Transmission of Power. Four lectures a week throughout the year.

Advanced Electrical Measurements and Electrical Testing.

In addition to these courses a meeting is held once a week, at which reports on the current electrical literature are made by the students.

DEGREE.—On the completion of this course the student is entitled to apply for the degree of Electrical Engineer. With his application, he must present a thesis on some subject connected with electrical science.

BUILDINGS AND APPARATUS:—The magnetic observatory is a brick building without iron in its construction, situated on Washington Street, in a position in which it is, as far as possible, free from the disturbing influences of large masses of iron. The main laboratory is in the basement. On the first floor are a reading room and a private laboratory, and on the second floor is a large room, which is used for special investigations. Among the instruments in the laboratory which deserve special mention are a large physical balance, Thomson's quadrant electrometer, Thomson's electrostatic electrometer, specially constructed galvanometers by Edclmann, Hartmann, and Elliott, Thomson's ampere balances, two large resistance boxes, adjusted by Anthony. Besides these, there is a full outfit of galvanometers, voltmeters, ammeters and all other instruments needed either in technical work or in exact investigation.

The dynamo building stands on the corner of Washington and William Streets. It is connected with the School of Science building. The motive power for the machinery is furnished by a sixty horsepower boiler and a Ball engine. The dynamo plant, at present, consists of a

Westinghouse alternate current machine with full set of transformers, a Mather, an Edison, a Brush arc, a Brush incandescent, an Eichmeyer, a Gramme, a machine constructed in the workshop of the School of Science, Brush and Eichmeyer motors. With these machines is a complete outfit of accessories, and a large rheostat of German silver used in testing the machines and for measurements. Arc and incandescent lights are so arranged that the various systems of distribution may be studied.

The dynamo building is connected with the magnetic observatory by heavy copper wires, so that the instruments of the observatory are available for experimental work with the dynamos. Four sets of storage batteries are also connected with the plant.

UNIVERSITY DEGREES AT PRINCETON.

The plan according to which University Degrees are now conferred at Princeton has been in operation since the year 1887 and has therefore been tested long enough to warrant an opinion regarding its efficiency.

I. GENERAL FEATURES OF THE PLAN.

The main features of the plan are taken from the requirements of the German Universities for the degree of Doctor of Philosophy. That is to say, the candidate for the Doctor's degree in Princeton has to select some one department as his Chief Subject of study. With this he must associate two cognate Subsidiary Subjects. After not less than two years of study he may proceed to his final examination, provided he has handed in a satisfactory thesis on some topic connected with his Chief Subject.

Other features of the Princeton plan are designed to adapt it more perfectly to our American College and University system. It is impracticable in this country to exact

a preliminary guarantee as uniform and definite as the German gymnasial diploma, which virtually settles the status of a Prussian student who seeks to become a candidate for the Doctor's degree. Yet something fairly equivalent to this is found to be a necessary safeguard against the entrance of immature candidates. To require that an intending candidate be a Bachelor of Arts before he can enter upon a course of study leading to the degree of Ph.D. would be sufficient as a safeguard provided the Bachelor of Arts degree in all American Colleges were sure to stand for a liberal education, and a common area of culture. But this is not always so, and to discriminate in favor of a Bachelor of Arts from one college and against a Bachelor of Arts from another college on the ground that one of them is liberally educated and the other not is an almost hopelessly difficult task. Individual merit differs so greatly that the risk of doing personal injustice is very evident. Moreover, it would be difficult to set a more invidious task for the Princeton faculty or for any faculty than to pass on the relative merits of the various colleges whose graduates present themselves as candidates for the Doctor's degree. Accordingly, while the Bachelor of Arts degree (and in one instance the Bachelor of Science degree) has been retained as a preliminary requisite, an additional safeguard has been introduced in the form of a preliminary examination. This varies somewhat with the degree sought. Thus for the degree of Doctor of Literature not only is the possession of the Bachelor of Arts degree required, but in addition an examination on English Literature and on the candidate's ability to read Latin, Greek, French and German sufficiently well to use them as instruments of investigation.

One other feature of the Princeton plan is that the Doctor's degree may, under careful restrictions, be conferred *in absentia*.

This requires longer study and greater expense than to secure a degree "in residence."

The minimum fees amount to one hundred and ten dollars. When the candidate pursues his studies for more than two years an additional fee of twenty dollars for each additional year is prescribed.

II. EFFECTS OF THE PLAN.

(1) The first and most obvious result of the new plan was to limit candidacy for the Doctor's degree to men of thoroughly serious intention and capable scholarship. To this there has been scarcely an exception. In the first year 1887-1888 there were but five candidates. In the second year 1888-1889 there were fourteen candidates. The present academic year 1889-1890 there are sixteen candidates. The greater number of these are graduates of Princeton, although other colleges such as Columbia, Amherst, Rochester and Baldwin University are represented. Of the Princeton men several are or have been Fellows. Nearly all the candidates are men who have devoted themselves to a professorial career.

(2) It is also of interest to note the subjects of study to which these candidates have devoted themselves. The list for the present year shows that of the sixteen candidates three take Mental Philosophy as their chief subject, three take Political Philosophy, three take English Literature, two take Greek, two take Modern Languages, two Astronomy, one Biology. The subsidiary subjects chosen include History of Philosophy, Ethics, Physiological Psychology, Political Science, Pedagogics, History of Modern Politics, English, Latin, Modern Languages, Mathematics and Physics. Eleven of the candidates are in residence and five are non-resident candidates.

(3) The number of degrees conferred has been small. Henry Dallas Thompson

received the degree of Doctor of Science, John Wahl Queen the degree of Doctor of Philosophy, Marion Mills Miller the degree of Doctor of Literature. These three are all. This is partly due to the increased severity of the requirements and partly to the fact that most of the candidates have not yet made themselves ready for the final examinations.

The general effect of the plan has certainly been to elevate the scholarly tone of graduate life at Princeton, to recruit a respectable though moderate number of special scholars, and to advance perceptibly the cause of university studies. The influence of resident candidates for higher degrees on the undergraduate body has been of value, and the privilege of non-resident study has not been abused thus far, but has resulted in stimulating men at a distance to do scholarly work, and has attached them to the college.

III. SUGGESTED IMPROVEMENTS.

The three years' experience of the new plan points out several directions in which it will be possible to increase its usefulness. First of all it is desirable that the wording of the plan be so clear that no misconceptions shall arise. To this end greater definiteness of statement is desirable in the provisions defining the departments of study. The character and extent of the specialization permissible in the Chief Subject of study might be made explicit. Another point needing attention is the severity of the requirements for the degree of Bachelor of Divinity. The altitude of these requirements is creditable enough as an ideal in scholarship, but the degree is so "high" that candidates "cannot attain unto it." In fact, there is now no candidate for this degree. Other points might be suggested, but fall outside the purpose of this paper. The general result of our three years' experience may be summed up in the statement, that the main elements of the new

plan have proved themselves thoroughly sound, and that what is now needed is improvement in the light of our recent experience and with the view of making the plan as direct, simple, intelligible and useful as possible.

PROFESSOR-ELECT WOODROW WILSON.

The new occupant of the chair of Jurisprudence and Political Economy is Professor Woodrow Wilson. He was born in Staunton, Virginia, December 28, 1856, and was prepared for college in private schools in Augusta, Georgia, and Columbia, South Carolina. He then attended Davidson College, North Carolina, for one year, 1873-74; after spending one year at home, he came (1875) to Princeton, where he was graduated in 1879. The next year and a half (October, 1879, to the Christmas of 1880,) were taken up by study in the law school of the University of Virginia. Obligated to leave the second year uncompleted on account of a threatened failure of health, he remained another year at home and was then (May, 1882,) admitted to the bar in Atlanta, Georgia. After a year's practice at the Atlanta bar, he yielded to the manifest call shown by tastes which had meantime been imperatively asserting themselves, and took up the systematic study of history and politics, going for that purpose to the Johns Hopkins University, October, 1883. He remained in Baltimore two years, being during the second year (1884-85) Fellow in History at the University, and publishing during that same year (February, 1885,) his work, entitled "Congressional Government; A Study in American Politics," which is now in its fifth edition, and which has become an authoritative commentary on our federal system in England and among specialists in Belgium and Germany. In 1885 he accepted the chair of

History in Bryn Mawr College, Pa., becoming a member of the first faculty of that college, which was opened to students in October, 1885. He took his degree of Doctor of Philosophy at the Johns Hopkins in due course upon examination, in June, 1886. In 1887 the honorary degree of LL.D. was conferred on him by Wake Forest College, North Carolina. In 1888 he was called to Wesleyan University, to the chair of History and Political Economy, which chair he occupied until the present year. In October, 1889, he published a college text-book, entitled "The State, Elements of Historical and Practical Politics," which has during the six months which have elapsed since its publication been adopted in twelve colleges, among them such as Harvard, Bowdoin, Brown, and Trinity.

He has been a somewhat frequent contributor to periodicals ever since 1879, writing for the *International Review*, the *Atlantic Monthly*, the *Overland Monthly*, the *Political Science Quarterly*, and the *New Princeton Review*. He has also written much for the newspapers, in the form of letters upon industrial and political matters, book reviews, etc. Of the four Princeton graduates who now occupy in various universities the chair of History and Political Science Professor Wilson is the senior and his Alma Mater sees in the return of her already famous son a happy omen for the increase of his own powers and reputation and for the development into just dimensions of numbers and influence of the great department of history, politics and public law.

ORIGINAL CONTRIBUTIONS.

THE NEW FACSIMILE OF THE VATICAN MANUSCRIPT.

By J. H. DULLES,
LIBRARIAN OF PRINCETON THEOLOGICAL SEMINARY.

The Seminary Library has recently had an interesting and a valuable acquisition in the newly published photographic facsimile of the Vatican manuscript of the New Testament, known as B among the uncials, and having the case number 1209 in the Vatican Library. This manuscript, perhaps the oldest of the four great uncials, dating from the latter part of the fourth century, has been in the Vatican Library since its foundation by Pope Nicholas V., in the fifteenth century. It has always been guarded very jealously and was not visible even to eminent biblical scholars until quite recently. Tregelles was allowed to see it under the eyes of two prelates, after he had been searched and paper and ink taken from him. It is said that he made some notes of it on his cuffs and finger nails. Tischendorf was more fortunate in having free use of it for forty-two hours, at the same time that Cardinal Mai's edition of it was being published, 1838.

After the discovery of the Sinaitic codex more liberty was allowed for the study of the Vatican codex. What Dr. Schaff terms a "quasi-facsimile" was issued during the years 1869-81, in five volumes, under the care of Vercellone and Cozza. This is a handsome reproduction, although not thoroughly reliable. The type used was that which Tischendorf had cast for his "facsimile" of the Sinaitic codex of 1863. The individual letters are in no true sense facsimiles of those of the Vatican manuscript, and are considerably larger, making the columns 6.5 cm. longer than those of B. Yet this reproduction has been influential in all the recent editions of the Bible.

The more liberal-minded Pope Leo XIII. permits accredited scholars to consult the original manuscript, and last year allowed it to be reproduced by the photographic process, page by page. The result is a marvel of beauty. Only the part containing the New Testament is completed. It is on sheets 41 cm. x 37.8 cm. The title-page is :

H NEA ΔΙΑΘΗΚΗ
—
NOVUM TESTAMENTUM
E CODICE VATICANO 1209
NATIVI TEXTUS GRÆCI PRIMO OMNIUM
PHOTOTYPICE REPRESENTATUM
AUSPICE
LEONE XIII. PONT. MAX.
CURANTE
IOSEPHO COZZA-LUZI ABBATE BASILIANO
S. ROM. ECCLESIE VICEBIBLIOTHECARIO.
[PAPAL SEAL.]
ROME
E BIBLIOTHECA VATICANA
AGENTE PHOTOGRAPHIA DANESI
MDCCCLXXXIX.

The gospel of Matthew begins on page 1235 of the codex and the facsimile ends with page 1518. The original vellum pages are shown to be 27 cm. square, although they vary somewhat in size. There are three columns of text on each page, covering a space 20 cm. x 18.5 cm. It may be assumed that the art of phototypography has given us an absolute reproduction of the ancient MS. This is apparent in the discolorations of age, the undulations of the vellum surface, the torn and mended edges, and the evidences of a greater use of certain parts than of others. To the eye the photographed page stands out prominently from the larger page of the facsimile. The text is extraordinarily clear and easily read.

The order of the books is as follows:

	PAGE.		PAGE.
Matthew, . . .	1235	Jude,	1443
Mark,	1277	Romans,	1445
Luke,	1304	I Corinthians, .	1461
John,	1319	II Corinthians, .	1477
Acts,	1382	Galatians, . . .	1488
James,	1426	Ephesians, . . .	1493
I Peter,	1430	Philippians, . .	1499
II Peter,	1434	Colossians, . . .	1502
I John,	1437	I Thessalonians, .	1506
II John,	1442	II Thessalonians, .	1510
III John,	1443	Hebrews (to 9:14),	1512

The pastoral epistles and Revelation are not contained in this codex.

The *Monitum* mentions certain scholars prominent in the line of textual criticism. They are Hug, Scrivener, Tregelles, Tischendorf, Burgon, Mai, Vercellone, Ceriani, Giovannini, Nestle, Gebhardt, Fabian, and Gregory. The last is an alumnus of Princeton Seminary. The omission of the names of Westcott and Hort from this list is remarkable.

The completion of this facsimile will enable American biblical scholars to study the exact text of the Vatican codex without the necessity of a journey to Rome. It is expected that the Old Testament will appear shortly.

SUMMER SCIENTIFIC WORK.

By WILLIAM LIBBEY, Jr.
PROFESSOR OF PHYSICAL GEOGRAPHY.

Last year's investigations upon the Gulf Stream and its relations to the Labrador current brought to light a number of interesting problems which will be examined this year. One result was obtained which was of value, viz.: that the general relations were found to change in a manner which showed that they were affected to a considerable degree by the meteorological conditions. This fact has served to outline the work for the coming season, and the main subject for study will thus be the limits of the areas of equal temperature and specific gravity and the effects produced upon this distribution by the winds.

Professor Mendenhall of the Coast Survey has taken an interest in this work and has detailed the steamer *Blake* for the purpose of cooperating in the investigation. The general plan of the work as adopted from the results of experimenting last year will be continued, but more attention will be paid to the direction and velocity of the currents.

The Fish Commission schooner *Grampus* will also continue her work in this field. These two vessels will do the active work upon the ocean, and in addition to the serial temperature and specific gravity observations a complete meteorological record will be kept and studies made upon the currents in the more interesting localities. In this work I shall be assisted by Prof. Rockwood, Prof. McNeill, Mr. L. W. Mudge, Mr. R. P. Bigelow, and Mr. A. Harris.

Last year our only means of comparison for the meteorological records was with those made in New York and Boston. This year, through the courtesy of the Light-house Board, we shall have a station upon the Nantucket New South Shoal Light-ship which is located 21 miles off the Island of Nantucket. Here a very interesting set of observations will be carried on in addition to the meteorological series and the records of water temperatures and specific gravities. They will consist of a study of wave and tidal phenomena; the observation of wind velocities on deck and at various elevations in the rigging, the systematic study of atmospheric electricity, and a record of the velocity and direction of the currents. Many of the instruments on the Light-ship will be self-recording, and some of them constructed especially for this work. The party here will consist of Mr. S. T. Dodd, Mr. J. Zimmerman and Mr. W. H. Dodd.

At my suggestion Col. McDonald has requested Mr. Fred. Neher to investigate the chemical qualities of the waters of

Long Island Sound, in order to ascertain whether the composition of the water and the presence of decomposing matter in it produces any effect upon the development of the oyster. These studies are to be made in connection with a careful investigation of the physical conditions of the waters, *i. e.*, the currents and the specific gravities; and the biological side of the question will also be taken into account.

All of these parties will be splendidly equipped with instruments, and some results will undoubtedly be obtained which will be of practical value. The Light-ship offers exceptional opportunities for the study of the problems to be taken up at that point. No pains have been spared by Col. McDonald to make the various portions of the expedition successful.

The report of last year is now in process of publication and will appear before long.

THE EFFECT OF ILLUMINATION ON ELECTRICAL DISCHARGE.

By S. T. DODD,
ASSISTANT IN PHYSICS.

In repeating in the Physical Laboratory the experiments of Elster and Geitel on the effect of illumination on electric discharge (Wied., Ann. 39, p. 332, 1890), I have arrived at results not altogether in accordance with theirs. The experiments in question were as follows. The two arms of a Henley's discharger were attached to the two poles of a Holtz machine in such a manner that the discharge might take place either between the arms of the discharger or the poles of the machine according to the distance by which they were separated. The poles of the machine terminated in balls while the discharger carried a ball on the positive and a disk of amalgamated zinc on the negative arm. If now the machine was set in action it was found by Elster and Geitel that a bright light falling on the apparatus inter-

ferred with the passage of the sparks between the ball and plate of the discharger. The light used by them was produced by burning magnesium tape at a distance of about fifty centimetres.

In repeating the experiments the arrangement was as far as possible the same, only that at first I used an arc light at a distance of four or five metres as the source of illumination. It was then found that if the poles of the machine were placed at such a distance that the sparks passed, in the dark, with equal facility either between the poles of the machine or the arms of the discharger, when the light was allowed to fall on the zinc plate the sparks passed only between the ball and plate of the discharger. In other words, the light helped the discharge instead of hindering it. The arrangement, if properly adjusted, was so sensitive that even if the screen, which shut out the light, was only lowered for the least instant, a shower of sparks always passed between the poles of the machine, which would give place to sparks between the ball and plate of the discharger as soon as the screen was raised.

The same results could be obtained by using sunlight; and even the light from burning magnesium tape had the same effect.

These results seem contradictory to those of Elster and Geitel and entirely in accord with those of Hertz and Wiedemann who found that light shining on a discharging point assisted the passage of a spark.

On the other hand, it was afterwards found that results in accord with those of Elster and Geitel could be obtained by using an arc light run with a little higher electromotive force, so that the arc itself was longer than was at first used. In this case, when the light was admitted, the passage of the spark between the ball and plate was instantly stopped. This effect was even more marked than the other. I have never failed to obtain it,

while on some days it was impossible to obtain any effect whatever with the other kinds of light.

It has been suggested that the failure to obtain the effects in some cases might be due to different conditions of atmosphere and temperature. If so, the same thing might lead to an explanation of the difference between these results and those of Elster and Geitel.

SUMMARIES OF PAPERS READ BEFORE SCIENTIFIC SOCIETIES.

HYPOTHESIS AND DOGMA IN THE SCIENCES.

By CHARLES W. SHIELDS,
PROFESSOR OF THE HARMONY OF SCIENCE AND RELIGION.

In this paper it was assumed as elsewhere proved, that Reason and Revelation are, or may become, subjective and objective factors in cognition and in science; but that their present relations are disturbed and abnormal as expressed in the conflicting hypotheses and dogmas which are based respectively upon the facts of Nature and the truths of Scripture.

For the present purpose, an hypothesis was defined as a scientific opinion and a dogma as a religious opinion concerning any set of phenomena to which they both refer; and logical rules or canons for the reconciliation of such hypotheses and dogmas were proposed as follows:

I. Hypotheses are to be tested as Dogmas within the province of revelation; and Dogmas as Hypotheses within the province of reason.

II. Hypotheses or Dogmas will preponderate in the ascending scale of the sciences according as reason or revelation has primary jurisdiction; the former prevailing in the physical sciences and the latter in the psychological sciences.

III. Conflicting Hypotheses and Dogmas can only be adjusted philosophically by ascertaining the problem of opinion or

the conditions of an ultimate judgment when all the relevant facts have become known and all the needed light has been shed upon them.

These canons were applied to existing Hypotheses and Dogmas in astronomy, geology and anthropology, in psychology, sociology and theology; their legitimacy was argued from the nature of empirical and metaphysical knowledge; and their utility was shown in the present state of philosophical opinion.

The paper will appear in full in the July number of the *Presbyterian and Reformed Review*.

[Abstract of a paper, read before the Philosophical Club.]

GERM-PLASM IN PLANTS.

By GEORGE MACLOSKIE,
PROFESSOR OF BIOLOGY.

The plant consists of two classes of structures, (1) the permanent or working parts, being the parts usually visible; (2) the constructive parts, forming new cells, usually hidden in the extremities of shoots and roots and in the seed, and in a few other regions where new cells arise. Cells are at first small, full of protoplasm, with large nuclei; but most of them subsequently enlarge, and become permanent tissue, subserving the various functions of plant-life, at the same time losing their power of forming new cells. It is only in the constructive parts, or embryonic tissue, as Sachs calls them, that new cells appear; and Goebel shows that in these parts we may distinguish particular cell-groups, which are of peculiar aspect and are destined to form the *primum-movens*, or starting point, of reproductive bodies (of pollen-grains, and of embryo-sacs, or of spores in flowerless plants). These cell-groups are the proper germ-plasm.

A historical review of theories shows that our knowledge of plant-life, and of

processes of reproduction, has been reached by a long course of guessing and speculating, often very erroneous; until by examining and criticising the views of different investigators the truth is evolved. The discovery of sexuality in plants by Camerarius in 1691, of protoplasm by Schleiden in 1838, and of alternation of generations by Hofmeister in 1851 were of chief interest; the last being the most brilliant discovery ever made as to animals or plants. Hofmeister traced the development of the moss-plant, cell by cell, and proved that twice in its course it starts from a condition of a single cell; in one case being an asexual spore, in the other case being a sexual oosphere fertilized by an antherozoid. This system of *alternation of generations* was soon extended to the ferns, and next to the conifers, and afterwards to the ordinary flowering plants, proving a community of processes of reproduction through all, and preparing the way for Darwin's view, which explains this unity of behavior by the hypothesis of community of origin.

The pollen-grains and the embryo-sac, which are the reproductive spores of a flowering plant, are derived from the germ-plasm concealed within the terminal buds. These, which may be many thousands in number, as on an oak-tree, and they all are historically descended from the oak-seed; the plasm of the buds being dormant in winter, but never dead, since the thousand years ago when it came out of the acorn of the now aged oak-tree; and the germ-plasm in that acorn may have come from the flower of another millenarian tree. Thus are we carried from generation to generation, the germ-plasm being continuous and immortal throughout the race, or possibly ever since the origin of the first vegetation.

Under this view the influence of the environment upon hereditary characters of plants must be very indirect. Yet there

is evidence of such influence in cultivated plants and in climatic changes which are constantly observed. This may be a basis for variations leading to new species; and may explain the Divine method of causing the earth to bring forth plants after their several kinds.

From the embryonic substance, which passes from one generation to another, are derived the visible parts of the plant by processes of cell-enlargement and change. In the working cells the protoplasm becomes vacuolated and weakened, so that new cells cannot ordinarily be produced in these regions. The seat of active germ-plasm seems to be in the nucleus, as cell-formation always proceeds by a division of the nucleus and a redistribution of protoplasm around new centres; and fertilization is found to depend on a combination of the nuclein of two cells. The fact that in mosses, willows, begonias, etc., any fragment may under favorable circumstances propagate the whole plant, seems to prove that Weismann drew too sharply his distinction between germ-plasm and ordinary protoplasm. This view is confirmed by the fact that many plants which are not known ever to propagate sexually, are vigorous and dominant. The better view appears to be that the plasm or living matter is nearly the same in all parts, specially concentrated and active in the reproductive cells and growing points, more diffused and vacuolated and therefore weaker in other parts, and in these last cases partially specialized as chlorophyll granules, etc., for the purposes of assimilation and metabolism. Thus, in the permanent parts the plasm may be supposed to gain new functions for the nutrition and growth of the plant at the expense of its primitive function of cyto-genesis, (or cell-multiplication).

[Abstract of a paper read before the Princeton Biological Club, May 15.]

THE UNITY OF THE ARTS.

By G. L. RAYMOND,
PROFESSOR OF ORATORY AND AESTHETIC CRITICISM.

The two requirements of art, namely, that of having forms modeled upon those of nature and that of expressing sentiment, are apparently antagonistic, and lead to two different theories and methods, each of which contains truth, but neither of which, if followed to the exclusion of the other, can lead to the greatest excellence in art or render possible a philosophic basis for classifying all the arts according to one principle in these statements illustrated by a review of the history of the classic and romantic tendencies. Classicism, in which form is emphasized; its rise, its earlier influence, and its later tendency toward imitative conventionalism and a consequent decline in each of the arts. Romanticism, in which the idea expressed in the form is emphasized; its earlier influence and its tendency toward extreme originality and formlessness in each of the arts. The statements above illustrated further by the different theories that have been held concerning the sources of beauty, by which it is attributed to form or to idea, and their results. The necessity of making the two requirements of the arts seem one, for the sake both of the artist and the critic; in order that individual products may contain all the elements necessary to excellence, and that a basis of classification may be found which can be equally applicable to the most idealistic and to the most imitative arts. The expression of sentiment is not inconsistent with the imitation of nature. But the object of art is not to express sentiment; neither is it to imitate nature. Inartistic forms are more successful than those of art in doing both of these. The exercise of mind that leads to the elaboration of forms of expression for their own sakes underlies art.

These are necessarily forms both of nature and of thought. Imagination, which is the source of this art-elaboration, is connected with a method of mental action which distinctly differentiates the man from the brute. Art is, therefore, a distinctively human development, and is connected with that tendency of mind which discovers in the forms and operations of nature, illustrations and communications of spiritual thought. This fact causes the influence of art to differ radically from that of science. Art uses the forms of nature, and therefore does not create. But by giving further embodiment to the ideas that are supposed to be expressed through these forms, it is necessarily creative.

[Abstract of a Paper on the Nature and Functions of the Arts, read before the Literary Club, Dec. 10, 1889.]

GOETHE'S HERMANN UND DOROTHEA.

By H. C. O. HUSS,

PROFESSOR OF MODERN LANGUAGES AND LITERATURE.

The classification of Goethe's *Hermann und Dorothea* is a point concerning which the most competent critics differ widely. W. von Humboldt saw in it an epic pure and simple; G. H. Lewes called it the most idyllic of all idyls; Schiller and P. Richter styled it an epic idyl; Hegel finally, an idyllic epic.

The most popular view is nowadays that of Lewes, yet it cannot be accepted for the reason that the poem lacks several of the most indispensable conditions of an idyl.

In the first place we miss seclusion and remoteness from the agitation and turmoil of the world. The crowds of panic-stricken fugitives on the near highway establish a very close contact with the outer world.

In the second place we miss security. The scene of action is situated almost at the foot of an active volcano, the French

Revolution. Dorothea herself is one of its victims. War is feared and prepared for in Hermann's home. A general levy has been held a few days ago. According to the testimony of the principal personages themselves nothing about them is safe; the very ground seems to tremble and rock under their feet.

In the third place the poem pictures scenes of gloom and horror which are incompatible with the idyllic mood. The first song is full of gloom. We are made eye-witnesses of heart-rending misery, and the poet entitles this song "Fate and Sympathy;" but Fate in the sense of *Schicksal* has no idyllic ring, and intense pity is not idyllic, but tragic. Also the judge's account of what he witnessed in the war with the revolting outrages committed and their bloody revenge is anything but idyllic.

Yet in spite of all that has been said to the contrary *Hermann und Dorothea* has some decidedly idyllic features: a small sphere of action, whose center is the family and the hearth, a simple, harmless and happy existence, man in harmony with himself and with nature, pure country air, all features which force us to admit that the poem, though not an idyl pure and simple, is nevertheless idyllic.

As to the question whether it is an epic, it must at once be conceded that it cannot claim to be an epic in the traditional sense, as it has neither heroic characters nor the grandeur of dimension, nor the complicated action, nor the sweep and powerful current of the great epics of Homer, Milton, Tasso, the *Nibelungenlied* and others. On the other hand it has in common with Homer's representative epic not merely the meter, but the whole manner of treatment. The poem was avowedly written in imitation of Homer, whose objectivity, continuity, naturalness, simplicity, plastic delineation of character and serenity of tone it

reaches. Goethe himself moreover used the epithet "epic" with reference to his poem. "I have separated in the epic crucible the purely human element of life from the dross."

Since the poem thus participates of the nature of both the epic and the idyl, its place is somewhere between the two, and since its manner of treatment is so thoroughly Homeric we have to put it down as an epic poem, in the first place; but since its dimensions and characters are idyllic, we have to qualify the designation accordingly and call it an idyllic epic.

[Abstract of a paper read before the Literary Club,
April 1890.]

UNIVERSITY LECTURES DELIVERED
BY MR. BENJAMIN IVES GILMAN ON
THE AESTHETICS OF MUSIC,
MAY 1890.

This course may be described as an investigation into the sources of musical pleasure from the standpoint of modern psychology.

A piece of music is a beautiful arrangement of sounds agreeable in themselves. But beside beauty of sound-pattern a musical composition may possess a charm due to the imaginative or emotional suggestions which it awakens in the mind. Musical pleasure has thus two sources, the auditory perceptions and the imaginative and emotional nature.

The first five lectures discussed those pleasures in music derived solely from the sense of hearing, the extra-auditory factor in musical enjoyment being treated in the last lecture under the head of Expression.

The material of musical composition is agreeable sound; either the single note (or mass of sound having a definite pitch) or the simultaneous combination of several notes into a chord. The first lecture, on Notes, discussed Helmholtz's discovery of their composite nature and his explanation of the differing charm of the notes of different instruments by differences in the

amount of interference between their elements.

In the second lecture, on Chords, an account was given of Helmholtz's application of this fact of the interference of elementary tones to explain the phenomena of consonance and dissonance. It was remarked that Helmholtz's theory, which reduces consonance to richness in the mass of tone without conspicuous interference between its elements, is no longer regarded as a completely satisfactory one; although no supplementary theory has as yet won general recognition.

The three succeeding lectures, on Modes, Style and Form, discussed the structure into which the materials of music, notes and chords, are wrought. Modes are the interval-orders within which music has moved; and the term may be interpreted to mean the known customary modes of tuning instruments of the harp or organ kind. After a discussion of the two great genera, to one or other of which all modes belong, the pentatonic and the heptatonic, the lecture on Modes concluded with a statement of the Principle of Tonality, through whose influence as a fundamental canon of musical structure, the Diatonic Mode, of ancient Greece grew into the major and minor scales of modern times.

The lecture on Style discussed the three methods of composition known to musical history. It was noted that in its more primitive stages music consists exclusively of simple sequences of notes or melodies. The rise of chord-music in the eleventh century was described and the influences were enumerated through which its first form of Counterpoint gave place at the Reformation to the existing Harmonic Style.

A more detailed examination of some of the structural characteristics of music as it at present exists, was the subject of the lecture on Form. It was attempted to give some account psychologically of the

facts of time, form and of harmonic structure in modern music, and of the themes and keys therein.

The last lecture, on Expression, turned from the consideration of music as an appeal simply to the auditory perceptions to discuss its power over the fancy and the feelings. This was found to depend chiefly on the suggestions of movements of other kinds awakened by the movements in pitch of which a musical composition consists; the chief characteristics of the imaginative and emotional suggestions of music being their strength and their indefiniteness.

The theories of Darwin and of Spencer, in which an evolutionary origin has been assigned to the emotional impressiveness of music, have not, it was stated, withstood the test of a closer examination.

A like unfavorable judgment has in recent discussion been passed upon the view with which the name of Wagner has commonly been associated, that the æsthetic value of music consists in its power over the heart. The beauty of a musical composition lies in its content as a pure complex of sound, and not in any fancies or feelings that may be associated with this.

SPACE AND SPACE DEFINITIONS.

By H. C. WARREN,

CHANCELLOR GREEN FELLOW IN MENTAL SCIENCE.

The view was formerly held that at the basis of geometry lay certain natural truths, which must be accepted as axiomatic, or necessary, although indemonstrable; as, for example, that two lines cannot enclose a space. The work of Riemann, Lobatchewsky and others has shown, however, that a consistent science of geometry may be built up without some of these—but a geometry of course different from Euclid's.

Gauss demonstrated mathematically that the folding of a surface makes no difference in its internal properties, so long as it is not stretched; there are internal characteristics (such as curvature) which can be discovered without reference to space of three dimensions. Riemann has shown from purely mathematical considerations that this distinction between external and internal properties can be extended to three dimensions and higher.

In the deductive science of geometry, the postulates determine the results. Hence in the science of actual space only experiment can determine the proper postulates. If we define parallel straight lines as "those that are equally far apart at two points," there are three possible cases. Space may be so constituted that perfectly straight lines, starting parallel, will at length meet—just as geodetic lines on the sphere meet at the pole. Then the three angles of a triangle bounded by straight lines will be *greater* than two right angles. Or again, the lines may diverge and the sum be *less* than two right angles. Or finally, the supposition of Euclid may prove true, and the lines neither approach nor diverge. The actual state of the case must therefore be determined by empirical considerations. It cannot be settled dogmatically that space *must* be flat, any more than that the planets move in circles—however "perfect" that form of motion be.

Kant argues for the synthetic *a priori* nature of space axioms. He takes as a *priori* the fact that space is of three dimensions; and although he nowhere expressly asserts it, Euclid's Axiom of Parallels would come under the same category. In the Kantian use, a *priori* means "rationally necessary." But (even supposing our sensible space to be flat), why is this the only kind of sensible space that can rationally be? The others are as self-consistent; physical motion of bodies

would be just as possible in a spherical space; the properties of solids can be calculated, with consistent results, for a space of four dimensions, and these results have always sense-interpretations when they involve only three dimensions. The ground of Kant's argument is overthrown, and we must reduce the *a priori* element in the space notion to the *conception of definite relations between elements*. The great result, as Helmholtz shows, is to cut in two the Kantian phrase "synthetic *a priori*." The space concept is one or the other, but not both.

From this it follows that the flatness of space and its limitation to three dimensions must be determined (if at all) by sense experience. First, as to the number of dimensions. Sense data are limited to three; and known physical laws, so far as they can prove anything, give evidence that *physical* space at least is similarly limited. Second, as to curvature. It can not be known intuitively that parallel straight lines do not intersect. For, if they are actually straight, we have not sufficient data, without assuming a special kind of space, to assert that they cannot meet; and if they are supposed never to meet, they cannot continue straight, excepting in that special case. The elaborate objections of J. B. Stallo can be met by insisting on the various possibilities for the sum of the angles in a triangle bounded by shortest lines. The question of the curvature of space is a purely trigonometric one, and so far as telescope, micrometer and our limited base-line can determine at present, space is *absolutely flat*.

[Abstract of a paper read before the Mathematical and Physical Club, May 15, 1890.]

SUMMARIES OF PAPERS PUBLISHED.

THE RELATION OF CHRISTIAN ART TO THEOLOGY.

By A. L. FROTHINGHAM, Jr.,

PROFESSOR OF ARCHAEOLOGY AND THE HISTORY OF ART.

In the history of Christianity art and literature were twin-sisters in the service of religion and illustrate its development equally well, each in its own sphere. Christian art was the expression of the highest thought in forms capable of being apprehended by the humblest intelligences and was at all times a message of the faith of the fathers to the flock and conversely an embodiment of the general belief. The councils, popes, civil rulers and prominent writers from the fourth century to the end of the Middle Ages, regarded art as the most important means for educating the masses in religious truths. In fact, on account of the general illiteracy, the artistic representation of theological and moral ideas was the only available method beside oral instruction. Pope Sixtus III, towards 435, dedicated to the people the whole series of mosaics in the Sta. Maria Maggiore, illustrating the Old and New Testaments, and from that time forward the science of art pedagogics was established.

This opinion, held during the Middle Ages, is justified when we examine into the correspondences between the monuments and the known phases of theological development. We find two great periods: the Early Christian, from A. D. 1 to 800; the Mediæval, from 800 to 1400. Both are divisible into three periods. The ontological ideas ruling from 1 to 300 A. D.; the theological tendencies of the epoch between 300 and 550; the humanitarian and psychological character of that lasting from about 550 to 800—all these characteristics are found in art as well as literature. In both, this is the most creative and original pe-

riod; in both there is a corresponding development and succession of leading ideas. Art is at first slow of growth and tentative in its efforts, but it soon, in the sixth century, takes its place side by side with literature, and even appears in some cases to precede it.

The second period is that of scholasticism, from 800 to 1400. It is intellectual and theological; it reasons more than it feels and has less inspiration than logic. In art it develops, supplements and systematizes for didactic ends the subjects previously created, and reaches its perfect development in the Gothic cathedrals of France, whose thousands of carved and painted figures form a general compendium of the knowledge and thought of the period. They contain figured treatises of theology, astronomy, anthropology and cosmology in the sphere of nature; of agriculture, manufacture, commerce and art, in the sphere of science; of the virtues and vices in the sphere of ethics; of the world's experiences from the creation to the Last Judgment in the sphere of history. These divisions are those adopted by the encyclopædias of the period.

There are two great divisions in art as in theology—the East and the West. The Eastern artistic imagination was by far the more fertile and creative and greatly influenced the West. Its types were more ideal, while those of the West always had a realistic bent. Even the Italian painters from Giotto to Michelangelo owe to the much despised Byzantine art the greater part of their ideas and the very details of their composition.

The relations between art and theology can be readily proved by dividing their subjects into common classes. The representations of especial importance are those (1) of the three persons of the Trinity; (2) of the person and life of Christ; (3) of the cult of the Virgin; (4) of the second coming of Christ and the Last Judgment;

(5) of Biblical history and legend; (6) of symbolic and allegorical subjects, etc.

The great problem is to systematize all the material so as to form a science of Christian Iconography. This work has been going on actively for nearly a half century in France, Germany and Italy. Classic archaeology is now held to be a necessary complement to the literature of Greece and Rome in order to obtain a better defined knowledge of the ancient world. Christian art and archaeology hold an even more important position and are keys to the store-house whence we derive a living, close and sympathetic insight into the thoughts and life of our Christian ancestors.

[Abstract of a paper read before the *Philosophical Society*; printed in the *Presbyterian and Reformed Review*, April, 1890.

THE MONASTERY OF FOSSANOVA.

By A. L. FROTHINGHAM, Jr.,

PROFESSOR OF ARCHÆOLOGY AND THE HISTORY OF ART.

The general views on the early introduction of primitive Gothic architecture into Italy by the Cistercian monks, at the close of the XII century, referred to in Vol. I, Nos. 1 and 4, of this BULLETIN, are illustrated in detail in this paper by the buildings of the monastery of Fossanova. The history of this monastery, of which a summary is given, is sufficient proof of its importance. Its foundation goes back almost to the time of St. Benedict. Its site is in a low and marshy tract, in the southern part of the Roman province, surrounded by thick woods and rugged hills, such as the industrious monk loved to reclaim and cultivate. In the time of St. Bernard it was given into the hands of the Cistercian order and soon rose to such importance as to be second only to the great parent monastery in France. At the close of the twelfth century its monks and lay-brethren numbered between 500 and 800, according to different estimates; this would

make it about the largest in Italy. All its buildings, as they at present stand, date from about this period. Its numerous colonies and subject monasteries were then founded, not only through the surrounding region but to the North, South and East; and as far down as Sicily and as far north as Tuscany. This helped to disseminate the early Gothic style embodied in its buildings. The Emperor Frederick Barbarossa was perhaps the most generous patron of the monastery, and it was largely through his gifts that the buildings were erected at Fossanova, as was shown by an inscription over the church door, now destroyed. The monastery, after sharing in the general decay of the order, consequent on the spread of the Franciscan and Dominican Orders, and after having its series of Commadatory Abbots, was finally abandoned. It was re-colonized, suppressed by Napoleon I., re-colonized again and finally suppressed by the Italian government, which has, however, declared the monastery a monument of national importance.

The buildings are enclosed in an immense walled quadrangle. A massive arched doorway, like the gate to a mediæval town, leads into a large court in which rise, on either side, the guest-house, chapel, abbot's house and store-houses. Opposite is the church, and attached to it on the right is the quadrangle or main body of the monastery enclosing the covered cloister. The church forms one side of it; the other sides are formed, above by dormitories, below by the chapter house, refectory, etc. By itself, to guard against infection, stands the hospital. In the immediate rear of the quadrangle, in the back court, stands a second guest-house and the church of the primitive monastery. All these buildings are aesthetically interesting; some like the church, the cloister and the chapter-house, are of a beauty seldom seen in architec-

ture in Italy. From the standpoint of history and construction, the church and chapter-house are of especial interest, the latter being a perfect specimen of early Gothic. The rest of the buildings are earlier and less advanced. The dates are approximately, as follows: Old cloister, c. 1150; hospital, c. 1160; guest-houses, dormitories, refectory, etc., c. 1160-1180; church, c. 1170-1208; new cloister and chapter-house, c. 1190-1215. As the church was consecrated in 1208 by Pope Innocent, it is tolerably certain that it was then finished; and there is no reason against believing it to have been completed a few years before. The authority for this date is the contemporary *Chronicon Fossanove*. The other dates are suggested by comparative study and the reasons for them cannot be exposed in this brief summary. Altogether, this monument not only represents, with almost unparalleled accuracy, the monastic establishments of the twelfth century, but is the best proof of the influence of French art in Italy at the time of the transition to Gothic; and independently of this historic interest, the artist will find material for study such as he seldom is so fortunate as to secure in the peninsula.

[Summary of a paper printed in the *American Journal of Archaeology*, Vol. VI, Nos. 1-2.]

A REVIEW OF THE CERNAYSIAN MAMMALIA.

By HENRY FAIRFIELD OSBORN,
PROFESSOR OF COMPARATIVE ANATOMY.

This remarkably interesting mammalian fauna of the lower Eocene of France has been derived exclusively from a small exposure of the *Conglomérat de Cernay* near Rheims and described in numerous papers by Dr. Victor Lemoine, Professor in the École de Médecine de Rheims. The collection is in the private museum of this author and his contributions are scattered through various French periodicals be-

tween 1878 and 1888. The Cernaysian fauna, it thus happens, is not thoroughly known or appreciated abroad except by the few who have had the good fortune to examine the original types. The fossils are, for the most part, in beautiful preservation and the skulls of *Arctocyon*, *Pleuraspidothidium* and other forms are finer than anything known from European strata of corresponding age. The abundance of the Insectivora is especially notable, for these beds promise to throw as much light upon the early history of this order as the Puerco rocks do upon the Ungulata and Creodonta.

In the course of two visits to Rheims, thanks to the hospitality of this French *savant*, the writer has collected the series of studies and sketches which form the material of this contribution. The principal features of each Cernaysian genus are described and illustrated, and an attempt is made to assign the true position to the Cernaysian beds and to determine the systematic relations of this unique fauna.

The Cernaysian is probably more recent than the Puerco, which stands at the base of the American Eocene series, for all the allied forms show a slightly higher degree of specialization. There are Lemnroids, primitive Carnivores, numerous Insectivores, the last survivors of the remarkable family of *Plagiulacidae*, but no Ungulates. All the animals are small excepting the flesh-eating *Arctocyon*. They have in common a number of primitive features, such as tritubercular teeth, plantigrade feet and a perforated astragalus.

[Printed in Proceedings of the Academy of Natural Sciences of Philadelphia, May, 1890,—pp. 51-69.]

ON GREEK SCULPTURED CROWNS AND CROWN-INSRIPTIONS.

By GEORGE B. HUSSEY,
UNIVERSITY FELLOW IN ARCHAEOLOGY.

Since the *De Coronis* of Paschalius, republished for the last time in 1680, there

has been but little further study given to the use of crowns in antiquity, and even still less to their representation in Ancient art. Greek sculptured crowns, as they still remain for the most part in the place where they were made, have thus practically passed hitherto unheeded.

They are carved on the face and sometimes on the sides of blocks of marble, and in a relief that is always less than 1 cm. high. Most of the wreaths appear as if they had been made of two pliable sprays or branches, whose woody ends are twisted around one another, and then the tips brought together, so that the whole forms a circle. Crowns won in the games usually have a fillet wound about them, but those given for services to the state are without one. From the beginning of the fourth century B.C. to the beginning of the fourth century A.D., there extends a tolerably continuous series of these reliefs, and their number, including fragments of wreaths, amounts to more than five hundred.

The great majority of these wreaths appear to be suspended against the stone, with the twisted stems at the top, and the tips of their sprays hanging below. Others stand erect, and so bring the tips of the sprays uppermost and the stem ends downward. The pendant crown belongs to the better periods of Greek art, while the erect one first appears on stone monuments in the time of Trajan or Hadrian. It shows itself on coins, however, much earlier; so that the erect position may have been borrowed from the coins, where such a position was for several reasons more suitable.

Laurel crowns are usually made with three leaves and two berries at each node of the stem. Ivy has its cordate leaf and often a bunch of berries near the tips of the branches. Parsley and pine have their peculiar foliage also imitated in the reliefs which represent them. A special

group of crowns with leaves standing out from the circumference of a circle, like rays of composite flowers, seem always intended for crowns of gold. Besides the reliefs, there are some instances of wreaths painted on marble; but these do not seem to be as old as the earliest reliefs, although it is a general principle that decoration in color precedes carving.

In the size of the crowns there is no regular progression; for although 16 cm. is about their average diameter, some are as large as 34 cm., or as small as 7 cm. There is, however, a change in the feeling of proportion that exists between the size of the crown and the size of the letters it incloses. Thus the ratio obtained by dividing the diameter of the crown by the average height of the inclosed letters is about 20 in the fourth century B. C., and decreases quite regularly to about 10 in the second century A. D. Various peculiarities in the treatment of stem and leaves can also be approximately dated. Thus a rigid regularity in arranging the leaves along the stem in groups of three belongs to the last two centuries before our era, and is a certain indication of decline in artistic spirit. The tips of the branches usually have smaller leaves in the earlier crowns and the quantity of foliage is lessened, as in the natural branch; but in late crowns the leaves are all of the same size, thus giving the wreath a dense, ring-like appearance.

Crowns usually contain a short inscription, an abridgment of the decree or speech conferring them. Wreaths given by the state or by civil assemblies usually have in their inscriptions three terms, the giver, the cause of the gift, and the receiver. Crowns won in any of the national games have two terms, the name of the games, and the name of the particular event in which a crown was obtained. Any or all of these terms of a crown-inscription may be, at times, omitted; they

may be all within the wreath, or some may be placed just above it; and finally, they may have different orders in respect to one another.

The instances where one of the terms is outside its wreath are all later than 150 B. C. The receiver (when present) is never outside; the cause very rarely; but the giver somewhat more often. The earliest wreaths are either vacant or else contain a single term, the name of the giver; so also the latest crowns have but one term, but with the difference that this term is not restricted to the giver, but may stand for the receiver. The number of the terms in crown-inscriptions is very variable, as well as their order. If the letters *g. c. r.* are taken to represent the three terms, giver, cause, receiver, then *g.* is the most frequent form of a crown-inscription. Next to it comes *r.*, followed by *gr.*, *gc.*, *ger.*, *c.*, *grc.*, *rg.*, *cr.*, and *rc.* In later times the function of the crown-inscription becomes greatly obscured, so that it may read across from one crown to the other, or may extend through a crown and out on each side of it, and thus let go all remembrance of the original three terms.

The division of a word in a crown-inscription, so that part of it is carried over to the line below, is found to be only sporadic before 200 B. C. During the last two centuries before our era it shows considerable increase, and in the time of the Roman Empire it becomes the established rule.

When three or more crowns occur on the same monument, they are usually placed in straight lines, very rarely in a diagonal relation to one another. If the geometric figure in which they are placed is preserved entire, the most important crowns are usually found to occupy prominent positions in it. These positions are the middle of a row of crowns, or else the left hand extremity of it.

When several crowns are of equal importance they may occupy various symmetrical positions, such as the ends of a row, or the corners of a square. The wreaths which occupy important positions owe their prominence to the rank of their giver or the value of the service for which they were conferred.

[Summary of an Article in Vol. VI, Nos. 1 and 2 of the American Journal of Archaeology, illustrated with reproductions of thirty typical crowns.

MISCELLANIES.

ON A COLLECTION OF FOSSIL MAMMALS FROM THE PHOSPHORITES OF QUERCY.

It has hitherto been a great difficulty in the way of the adequate study of American fossil vertebrates that so few opportunities of direct comparison with the longer known forms of the old world have existed in this country. Figures, descriptions and even casts are but unsatisfactory substitutes for original specimens, and too great a dependence upon these substitutes has led to many important errors in the accounts given of American discoveries.

The E. M. Museum has for several years past been endeavoring to secure an adequate representation of both continents in its collections and in many instances with gratifying success. Thus, in addition to the very extensive series of mammals obtained by the various expeditions to the West, there have been purchased a large number of Devonian, Carboniferous and Mesozoic fishes and Jurassic reptiles and Quaternary mammals from England and Germany; also a very large collection of mammals, reptiles and birds from the lower Miocene of St. Gerard le Puy, France. In addition there have been received in exchange from the museums of Paris, London and Munich, a considerable number of specimens representing the Oligocene formations of Debruges and Quercy,

the Miocene of Sansan and Ulm, and the Pliocene of Pikermi and Leberon.

The liberality of several friends has enabled the Museum to purchase a very choice collection of the beautifully preserved mammals from the phosphorites of Quercy, which forms a most valuable addition to our resources. The numerous specimens have as yet been only partially identified, but the following genera are well represented. What renders the collection especially valuable is the number of complete skulls and jaws which it contains.

LEMUROIDEA, *Adapis*, *Necrolemur*.

CREODONTA, *Hyænodon*, *Pterodon*, *Thereutherium*, *Cynohyænodon*.

INSECTIVORA, numerous mandibles, not yet named.

CHEIROPTERA, *Pseudorhinolophus*, with many other unidentified jaws and limb bones.

CARNIVORA, *Cynodictis*, (several species) *Cephalogale*, *Ælurogale*, *Cynodon*, *Palæoprionodon*, *Stenoplesictis*, *Amphictis*. This latter genus, known hitherto only from fragments of jaws, is represented in the collection by a perfect skull of an undescribed species. In addition to the genera enumerated, there are in the series many viverrines and mustelines, not yet named.

RODENTIA, one skull and thirty lower jaws, not identified.

PERISSODACTYLA, *Aceratherium*, *Palæotherium*, *Anchilophus*, *Cadurcotherium*.

ARTIODACTYLA, *Anthracootherium*, *Gelocus*, *Prodremotherium*, *Plesiomyx*, *Cainotherium*, *Xiphodotherium*, *Dichobune*, *Palæochærus*, *Bachitherium*, *Dacrytherium*, *Anoplotherium*, *Cebochærus*, *Haplomyx*, *Lophiomyx*, together with many unnamed vertebræ, limb and foot-bones.

MARSUPIALIA, *Didelphys*.

There are in all about 40 genera and 70 species of mammals represented by 8 com-

plete skulls, 171 specimens of jaws, upper and lower, and several hundred limb and foot bones and vertebrae.

THE AMERICAN ORIENTAL SOCIETY.

The American Oriental Society will hold its next annual meeting in Princeton, October 22. This will be an interesting occasion, as it is about fifty years since the Society met here, the first and, until now, the only time. Meetings have been held heretofore in New Haven, Philadelphia, Baltimore and New York. Professors Frothingham and Marquand have been appointed a Committee of Reception. It is to be hoped that the scholarship of both Seminary and College may be largely represented at the meeting.

At its May meeting, held in Boston, Professor Frothingham was appointed one of the Directors of the Society.

THE ARCHÆOLOGICAL INSTITUTE.

The annual meeting of the General Council of the Archæological Institute of America was held in New York on May 10, in the Trustees' Room at Columbia College. Professor Marquand attended as a delegate for the New York Society, and Professor Frothingham represented Baltimore. New officers were chosen, President Seth Low, of Columbia, being elected President.

UNIVERSITY AND SCHOOL EXTENSION.

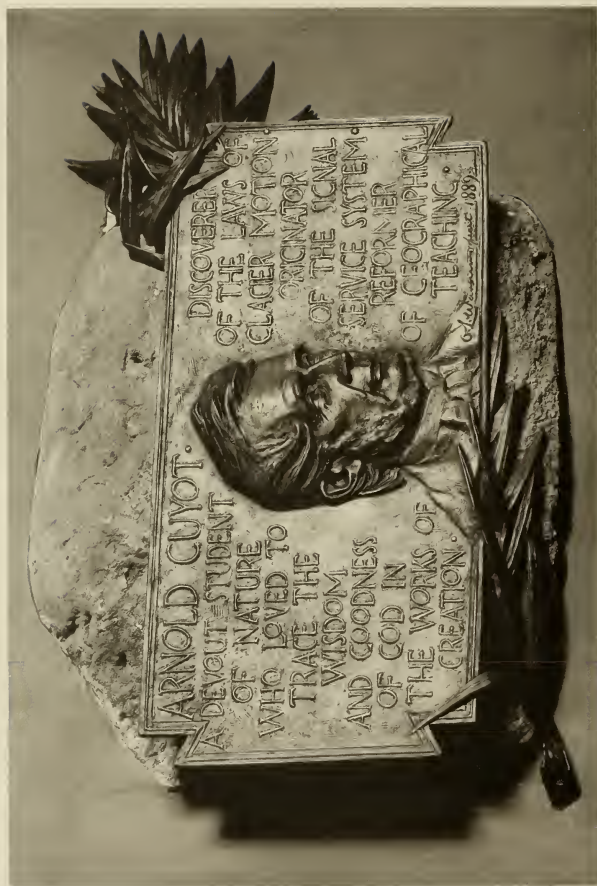
At the third and last meeting, held in the interest of University and School extension in New York, President Patton made the principal address. He promised a hearty co-operation on the part of Princeton professors, in carrying forward the work. Two organizations have already issued from this movement. One of these will devote itself to the work of

University and School extension, and devise practical means of bringing the advantages of the schools and universities to those who cannot avail themselves of them in the regular way. Of this organization Mr. James W. Alexander, Princeton, '60, is president, and Mr. Seth T. Stewart, Yale, '70, is secretary. Mr. M. Taylor Pyne, Princeton, '77, has been elected to the Board of Directors. In the University Faculty the following departments are in charge of Princeton professors: ASTRONOMY, Prof. Young; PHYSICS, Prof. Brackett; PHYSICAL GEOGRAPHY, Prof. Libbey; BIOLOGY, Prof. Osborn; ARCHÆOLOGY AND ART, Prof. Frothingham. The second organization will have the character of a club, for the discussion of educational questions. President Gates, of Rutgers, is chairman, and Prof. Marquand is a member of the organization committee.

NOTES.

Prof. Raymond has nearly completed three works, each of about the size of his "Poetry as a representative Art." One is philosophical, and deals with the different kinds of truth, and the methods through which the forms of nature suggest it, and those of science and art express it. Another derives the forms of art from the laws of matter and of mind, and endeavors to show how these necessitate and should influence its forms. The third endeavors to show, historically and critically what the arts are, and what is the bond of unity between them.

Professor Frothingham has lately delivered lectures: in Brooklyn, before the Brooklyn Institute, on "Byzantine and Romanesque Architecture;" in New York, before the Archæological Institute at Columbia College; and in Baltimore at the Johns Hopkins on "Ancient Cities and Monasteries Near Rome."



ARNOLD CUYOT.

A DEVOUT STUDENT

OF NATURE

WHO LOVED TO

TRACE THE

WISDOM

AND GOODNESS

OF GOD IN

THE WORKS OF

CREATION.

DISCOVERER

OF THE LAWS OF

CLACIER MOTION.

ORIGINATOR

OF THE SIGNAL

SERVICE SYSTEM.

REFORMER

OF GEOGRAPHICAL

TEACHING.

6/11/1889

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. II.

NOVEMBER, 1890.

No. 4.

THE GUYOT MEMORIAL.

Several years ago a circular letter was sent to the pupils of Dr. Guyot requesting their coöperation in placing a tablet to his memory in the Marquand Chapel. At the same time it seemed appropriate that his older pupils across the ocean in Neuchâtel should be given an opportunity to join in the proposed plan. A letter was written to Mr. Charles Faure, Secretary of the Geographical Society of Geneva, and he was afterwards visited, with the view of securing an erratic boulder to form the basis of the tablet. Such a decided interest was taken in the matter that a law prohibiting the removal of these boulders was suspended and a large stone weighing some four or five tons was placed at our disposal. This rock was transported from the vicinity of Neuchâtel, the old home of Dr. Guyot, to New York. A portion weighing over half a ton was sawn from it, and imbedded in the Chapel wall. Upon this was placed a Roman tablet, resting on a palm branch, as will be seen in the plate.

The monument was designed and executed by Mr. Olin Warner of New York, and was unveiled on June 10th, 1890. The address of presentation was made by Professor Libbey, and President Patton received the gift on behalf of the College. In the course of the exercises the following letter from Professor Dana was read.

New Haven,

DEAR PROF. LIBBEY.

I feel that there is a kind of claim upon me for a duty—a speech of only a few words about my friend Guyot,—and I should not hesitate were I not, as regards health, wholly unfit for it. Can you not take the enclosed words and introduce them into your speech as my testimony to him;

“Besides his work as an educator and author, the two great features of Dr. Guyot’s scientific work were the discoveries upon which are based some of the most important of the views now accepted relating to glacier motion and structure; and his meteorological studies which served as the basis for the development of the United States Signal Service system.

In a paper read before the Geological Society of France, at a meeting at Porrentruy in September, 1838, he says “that from the examination of the glaciers of the Aar, Rhône, Gries, Brenva and others he learned, 1) the law of the moraines; 2) that of the more rapid flow of the center of the glacier than the sides; 3) that of the more rapid flow of the top than the bottom; 4) that of the laminated or ribbed structure; and 5) that of the movement of the glacier by a gradual molecular displacement, instead of by a sliding of the ice mass.”

The communication is mentioned in the Bulletin of the Society for 1838, (volume

IX, page 407), but no report of it is given because the manuscript remained in his hands unfinished, in consequence of his protracted illness the winter following. The portion then finished (which was withheld from publication because, by special arrangement between them Agassiz in 1840 entered upon the special study of the glaciers, and Guyot upon that of the Swiss erratic phenomena, for their separate parts of a general survey), has recently been printed in Volume XIII (1883) of the Bulletin of the Neuchâtel Society of Natural Sciences. In 1842 this manuscript was deposited by motion of Agassiz, in the archives of the Neuchâtel Society, and in 1848 it was withdrawn by Guyot when he left for America. It is to be regretted that publication was not substituted in 1842 for burial.

Guyot's communication of 1841, published in the *Altendorf Verhandlungen*, was drawn out by a discussion between Forbes and Agassiz relating to priority as to observations on the blue bands, and it was made just five days before Forbes' first letter was read in Edinburgh.

Agassiz claimed credit for Guyot at the meeting of the Royal Society of Edinburgh in 1841, as a set-off against Forbes' claim, and again in the *N. Phil. Journ.*, Vol. XXXIII, 265 (1842). Forbes in the following volume of the *Journal* XXXIV, 145 (1843) gives Guyot credit for original discovery as regards the "blue bands" and speaks of his corresponding with him on the subject; and he repeats the acknowledgment to the "ingenious professor of Neuchâtel" in his "Travels through the Alps of Savoy, 1843."

"An important portion of Guyot's meteorological labors consisted in the selection and establishment of meteorological stations. With this object in view, he made in 1849 and 1850, under the direction of the Regents of the University of New York, in conjunction with the Smithsonian Institution, a general orographic

study of the State of New York, in order to ascertain the best locations for such stations. Thirty-eight stations were then located by him at points widely distributed over the State, and at the same time, patient, earnest Guyot, took pains to instruct observers at the stations in the use of the meteorological instruments. Similar work was also done under like auspices in the State of Massachusetts."

The report of the Regents of the University of New York for 1851 contains the topographical results of the exploration giving an excellent sketch of the high plateaus and larger valleys of the State. Thus Guyot went almost immediately to work in his favorite fields, laying the foundations for geographical investigation, and for a national system of meteorological observations and records. The national plan was not then inaugurated; but the work thus carried forward under the Smithsonian Institution was the initiator, in fact, of our present system.

His Neuchâtel pupil, M. Faure, well observes: "He cared little for renown, but much for the study of nature, and for the education of man."

My academic memoir of Guyot closes with the following sentence: "As fellow-students, we have special reason to admire in Guyot—as he wrote of Humboldt—that ardent, devoted, disinterested love of nature, which seemed like a breath of life, to pervade all his acts; that deep feeling of reverence for truth, so manifest in him, which leaves no room for selfish motives in the pursuit of knowledge, and finds its highest reward in the possession of truth itself." I know this to be a just tribute. I loved him as I have loved no other man, found great delight and profit in his conversation, and inspiration in his exalting views of nature and of God's work in creation, and it is a great pleasure to me to know that there is soon to be at Princeton a tablet to his memory.

Yours sincerely, JAMES D. DANA.

MEETING OF THE ORIENTAL SOCIETY.

According to the program mentioned in the last BULLETIN the American Oriental Society held a semi-annual meeting in Princeton, October 22 and 23. There were two public sessions, for the reading of papers, in Murray Hall, at 3 P. M. on Wednesday and at 10 A. M. on Thursday. Of the sixteen papers presented only a small number could be read. Among the speakers were: Professor Maurice T. Bloomfield, on "Mourning women in the Atharva Veda" and on the ceremonial of extinguishing the funeral pyre in ancient India, illustrating a passage in the Rig Veda; Dr. A. V. W. Jackson, on the meaning of the Avestan word for "molten metal" used in the Gathes in its theological application; Professor Collitz, on the primitive Arian sibilant *sh*; President Martin, on the belief of the various ancient Chinese sects regarding inspiration; Prof. Martin, on the question whether Pahlavi was a radically Semitic idiom, ideographic or syllabic; Professor Moore, on the meaning and etymology of some Semitic words, especially the name of the land of Canaan, etc.; Prof. W. R. Harper on "Notes on the Syntax of the Tiglat Pileser inscriptions," showing the unusual rigidity of its syntax.

It was decided to meet but once every year, and on Wednesday evening the Faculties of the College and Seminary were invited to meet the Orientalists at an entertainment given by Professor Marquand at his house, where he and Professor Frothingham acted as a reception committee.

There were several meetings of the Board of Directors composed of Messrs. Ward, Gilman, Hopkins, Lanman, Bloomfield, Gottheil, and Frothingham. It was decided to publish in full instead of in abstract a large proportion of the papers presented for the *Proceedings* of the Society, and also to take measures whereby the Society may hold its annual business meeting elsewhere than in Boston, to

which city it has hitherto been confined, according to its constitution. Dr. Adler presented for the consideration of the Society a proposition from the Commissioners of the Foreign Exhibits at the Chicago Centennial Exhibition, requesting that the Oriental Society lend its assistance to an attempt to reproduce the condition of the arts, sciences, manufactures and social conditions of the ancient East—in Babylonia, Assyria, India, China, etc. The Society agreed to offer any scientific assistance in its power.

Among the members present were: the President, Dr. Wm. Hayes Ward, editor of the New York *Independent*; Prof. C. R. Lanman of Harvard, the Corresponding Secretary; Professors Gottheil, Jackson and Perry of Columbia; Prof. Moore of Andover; Rev. Dr. Trumbull of Philadelphia; President Gilman, Prof. Haupt and Dr. Adler of the Johns Hopkins University, Baltimore; Prof. Wm. R. Harper, and Dr. R. F. Harper of Yale, with six or seven Yale students; Dr. Jastrow of the University of Pennsylvania; Professors Collitz, Smyth and Hopkins of Bryn Mawr College; President W. A. P. Martin of the Imperial Tung Wen College, Peking; Prof. W. R. Martin of Trinity College, Hartford; Professors Davis and Green of the Theological Seminary, and Frothingham and Marquand of the College, Princeton; Rev. Lysander Dickerman of Boston; Rev. J. K. Wight, etc.

Besides the reading of papers the Society occupied itself with the discussion of the important question whether it should exchange its Massachusetts charter, under which it has existed for a half century, for a national charter. The motion to seek a national charter was made at the previous meeting by Dr. Adler and referred to the Directors. The Directors' report made at this meeting was to the effect that they could not now recommend that the Society apply for such a charter.

CLASS OF 1881 MEMORIAL.

The Class of 1881 in celebrating their decennial will present to the College a collection of casts of Ancient and Mediæval Sculpture, to be placed in the Museum of Historic Art. This collection will occupy the whole of the lower floor of the present building. The class has wisely decided to limit the field of selection, so that the casts may be of the utmost service in connection with the courses on ancient and mediæval art now given in the College. The Professors in charge of the department are now occupied in making up a list of casts which may be obtained through European museums. It may be roughly stated that the collection will contain a few representative examples of Egyptian and Assyrian sculptures, a large number of Greek, a few Roman, and many specimens of Romanesque and Gothic art. As the aim in the selection has been to secure a series of illustrative examples for the history of the art of sculpture, a comparatively large proportion of the collection will consist of bas-reliefs and statuettes, while the larger monuments will be represented as well as the facilities for exhibition will permit.

Any one who has recently visited the Boston Museum or the charming Slater Memorial at Norwich, Conn., will be able to appreciate how attractive as well as instructive a collection of casts may be. The Princeton collection will have a character of its own, somewhat different from either of these, and, it is hoped, will form a nucleus around which other similar collections may be gathered in the coming years.

A NEW PRECURSOR OF THE RENAISSANCE.

By A. L. FROTHINGHAM, Jr.

The first decade of the fifteenth century which witnessed the earliest steps of the Renaissance of the Fine Arts, is one of

unusual interest. It was then that Ghiberti and Donatello were laying the foundation for their fame. Only a few prominent artists of this time have left any works. Jacopo della Quercia is almost the only other well-known artist in Central Italy who was then in the full exercise of his talents.

The origin of the Renaissance being a matter of so much interest and comparative obscurity, any contribution to our knowledge of it must be welcome. I believe it possible to add another name to the list of Italian sculptors that stand on the border-land between the receding Gothic and the advancing Renaissance. He is named Paolo and his birthplace is the town of Gualdo Cattaneo in Umbria not far from Spoleto. During the summer of 1889 I came across a sepulchral monument by his hand in the church of S. Francesco at Vetralla, about fifty miles north of Rome. It is that of a member of the famous Vico family of Rome, allied to the Monaldeschi and Anguillara families. The life-size figure of the sturdy warrior is of realistic execution. The epitaph consists of a long metrical inscription in late Gothic characters; on the upper moulding is the artist's name: *M. Paulus de Gualdo Cattanie me fecit*. I attributed this work at first sight to the closing years of the fourteenth century.

About six miles nearer Rome is the city of Capranica and there, in the church of S. Francesco, I came upon what appeared to me undoubtedly the unsigned masterpiece of the same sculptor, Paolo de Gualdo Cattaneo. It is a magnificent double monument erected to two members of the Anguillara family who owned a large part of the surrounding country. The entire height of the tomb is over twenty feet. The sarcophagus itself rests upon twisted columns and supports two colossal reclining figures in full armor placed in a niche whose curtains are drawn back by two angels and on whose roof are placed a

standing group of the Virgin and Child and two small kneeling figures of the deceased. This entire structure is enclosed by a canopy consisting of slender columns supporting a gabled trefoil pointed arch. The general form of the canopy is Gothic; the details verge on the Renaissance. The reclining figures are far superior to the slightly anterior productions of the Venetian, Veronese, Milanese and Neapolitan schools. They are good examples of the realistic side of the Renaissance, which was developed earlier than the more refined and classic element. Donatello's career illustrated in itself alone the manner in which these two tendencies succeeded and were amalgamated with each other.

An examination of this monument shows that its author while not breaking entirely with Gothic traditions was traveling along the high road to the Renaissance. The demonstration of this fact will be given later by means of photographic reproductions. I am disposed to attribute to the same artist another admirable tomb, that of Cardinal Marco da Viterbo, which is in the choir of the church of S. Francesco at Viterbo. The Cardinal died in 1369, but the monument was not erected until some years after by his pupil and friend Julian, general of the Franciscan order. Beside reasons of style there are several other arguments for regarding these three as works by the same hand. All have metrical inscriptions in similar style and lettering; all are in churches of the Franciscan order; and in cities within a few miles of each other.

The artist whose works are here chronicled is not mentioned, to my knowledge, in any work. He was evidently a leading sculptor in Central Italy. Perhaps he is the same as the well-known sculptor Paolo Romano, mentioned by Vasari, who, later in the century,—but not too late to exclude this identification—flourished in Rome

and may have received his epithet not from his birth but from his later residence in the Eternal city.

THE PRINCETON SCIENTIFIC EXPEDITION OF 1890.

This expedition, the eighth which the College has sent out, chose as its field of operations the deposits of the White River Miocene, as developed in the bad lands of Northern Nebraska and South Dakota, to a large extent the same region as was explored by the party of 1882. This course was adopted because the long continued study of the collections secured in 1882 showed many important gaps, both in the genera and species represented and in the completeness of the specimens. Although the same general region was revisited, a somewhat different portion of it was examined, especially the buttes bordering the South Fork of the Cheyenne River, on the banks of which a permanent camp was established. The work of collecting was successful to a most gratifying degree, especially in the way of obtaining nearly complete skeletons of animals which have hitherto been known from fragmentary specimens, and which will render possible the restoration of some forms of the highest morphological interest. The most important "finds" were in the groups of the rhinoceroses, horses, camels, dogs and insectivores, and what was still more unexpected, some undescribed genera were obtained, a certainly surprising fact when it is remembered that the White River beds have been known a much longer time and have been hunted over much more frequently than any other of the western tertiaries.

It is of especial interest to observe that some of these newly discovered forms strongly confirm the view that the White River beds correspond to the lower Oligocene of Europe. They largely increase the

number of known correspondences between the White River formation on the one hand, and the Uinta and Bridger on the other.

The expedition fitted out at Fort Robinson, Nebraska, where every courtesy and facility was extended by the officers, especially by Col. Tilford, Lieuts. Finley and Day, and Dr. Kean, to whom the cordial thanks of the members of the party are due.

The expedition was composed of Professors Seott and Magie, in charge, and of Messrs. C. and G. Agnew, Gladwin, Green, Lewis, Lyon and Mixer, all of the present Senior class.

Following is a partial list of genera obtained.

INSECTIVORA. Leptietis, Ictops.

CREODONTA. Hyænodon, Gen. nov.

CARNIVORA. Daphænus, Cynodictis, Hoplophoneus, Dinictis.

RODENTIA. Palaolagus, Ischyromys, Seiurus?

ARTIODACTYLA. Perekærus, Oreodon, Agriochærus, Poebrotherium, Leptomeryx, (?) Hyotherium.

PERISSODACTYLA, Meshippus, Mesotapirus, Metamynodon, Hyæædon, Aæratherium, Titanotherium, Gen. nov., etc., etc.

It may be added in this connection that Mr. L. S. Davis, who accompanied the expedition of 1889 as a guide to the John Day region in Eastern Oregon, and was employed afterwards to collect for the Museum, has lately sent in an important series of mammals from the John Day and Loup Fork deposits of Central Oregon. It is, however, not yet possible to give a list of these.

"SEPTEM ARTES LIBERALES."

By ANDREW F. WEST.

The object of this note is to point out the evidence for the gradual transformation of the older phrase *artes liberales* into *septem*

artes liberales and to point out the significance of this slowly accomplished change as an indication of the gradual christianizing of the *artes liberales* of the ancients.

I.

It is well known that the origin of the sevenfold division of ancient sciences goes back to the time of Aristotle and Speusippus, who succeeded in effecting the division of all subjects of study into Grammar, Rhetoric, Dialectics (or Logic), the three earlier disciplines in education, and Arithmetic, Music, Geometry and Astronomy, the four succeeding disciplines. These *ἐλευθέρια μαθήματα* of the Greeks were inherited by the Romans and became their *studia liberalia* (Ulpian, Digest 50: 13, 1). Their familiarity to educated Romans of the late Republic needs no proof outside the familiar references to *artes liberales* in Cicero's writings, such as *artium liberalium magistros* (*De Inventione* I. 25) and *has artes quibus liberales doctrinæ atque ingenuæ continerentur* (*De Oratore* III. 32).

II.

As Roman paganism passed away and the decadence of its culture set in, the attitude of the early Fathers of the Church toward the liberal arts is twofold. Some, like Tertullian, proscribe heathen learning as vain and immoral, and this fierce feeling lingered well toward the close of the Middle Ages. Indeed so late as the thirteenth century one of the regulations of the Dominican order prohibited anything beyond the barest preliminary or casual knowledge of the liberal arts. The regulation reads: *In libris gentilium philosophorum non studeat, et si ad horam suscipiat sæculares scientias non addiscat, nec artes quas liberales vocant*. The other attitude is one of qualified approval on the express ground that secular learning contributes to the understanding of Holy Scripture. Jerome and Augustine in the fourth century might be cited freely to

this effect. The expression *artes omnes illæ liberales* and a full discussion of the question involved may be found in Augustine's *De Ordine* (II. cap. 16. Migne xxxii. 1015).

III.

Accounts of the *artes liberales* continue in the later pagan or quasi-Christian writers. Early in the fifth century Martianus Capella gives a full account of each one, but, though he enlarges on the meaning of the septenary number or *heptas*, never thinks of connecting its significance with the number of the arts. Nor is the expression *septem artes liberales* to be found in Boethius, though he wrote on several of the arts early in the sixth century.

IV.

The first approach toward it occurs in the Preface of Cassiodorus to his treatise *De Artibus ac Disciplinis Liberalium Litterarum*, written about A. D. 560. He had previously written his *De Institutione Divinarum Litterarum* in thirty-three chapters, one for each year of our Lord's earthly life. He thinks it fit, therefore, that his treatise on the liberal arts should also be divided into parts, according to a suitable sacred number. Seven is of course the one number that will match the arts. So he writes: *Nunc tempus est ut aliis septem titulis sæcularium litterarum presentes libros percurrere debeamus. * * * Sciendum est plane quoniam frequenter quidquid continuum atque perpetuum Scriptura Sancta vult intelligi, sub isto numero comprehendit; sicut dicit David: Septies in die laudem dixi tibi. * * * Et Salomon: Sapientia ædificavit sibi domum, excidit columnas septem* (Migne LXX. 1150). Here is a new reinforcement coming from Scripture itself in behalf of the liberal arts. The old plea for them was that they helped toward understanding the Scriptures. Cassiodorus brings a new consideration, slight enough as it seems in our eyes, but forcible to the mystical number worshippers of the Middle Ages. The

arts are seven. But this is the Scriptural number for what is complete and perfect. Hence the importance of liberal studies to the Christian.

It is well to notice, in passing, that though Cassiodorus proceeds to set forth the seven arts in order, one chapter for each, he does not attain to the expression *septem artes liberales*.

V.

Another step towards the yet future expression is taken by Isidore of Seville. In his *Etymologiæ*, written about A. D. 636, he says: *Disciplinæ liberalium artium septem sunt* [I. cap. 2].

VI.

A century and a half after Isidore comes the founding of Christian schools by Alcuin in the time of Charlemagne. Alcuin in his *Grammatica*, written about A. D. 790, argues boldly from Scripture in behalf of the arts. Taking up the text from Proverbs quoted by Cassiodorus, *Sapientia ædificavit sibi domum, excidit columnas septem*, he develops it with a fine naïveté. His argument is as follows: Legimus, Salomone dicente, per quem ipsa se cecinit (*Sapientia*): *Sapientia ædificavit sibi domum, excidit columnas septem* (Prov. IX, 1). *Quæ sententia licet ad Divinam pertinet Sapientiam, quæ sibi in utero virginali domum, id est corpus, ædificavit, hanc et septem donis Sancti Spiritus, confirmavit; vel Ecclesiam, quæ est domus Dei, eisdem donis illuminavit; tamen sapientia liberalium litterarum septem columnis confirmatur, nec aliter ad perfectam quamlibet deducit scientiam, nisi his septem columnis vel etiam gradibus exaltetur* (Migne CI. 853). The plea advances beyond the position of Cassiodorus, who argued from the sacred number seven in the Scriptural text. Alcuin asserts that the speaker in the text, *Sapientia* or Wisdom, which in the speech of his time often meant learning and pre-eminently sacred learning, is said to have "builded her

house" and to have "hewn out her seven pillars." Then after showing the mystical bearing of this on Christ and on the Church, both endued with the seven gifts of the Spirit, he proceeds to his third application, which is bold assertion, "Wisdom is upheld by the seven pillars of liberal letters, and can bring us to knowledge in nowise unless it be exalted on these seven pillars or approaches." It needs not to be told how influential on Christian schools was this attitude of Alcuin, the virtual minister of education under Charlemagne. The phrase *septem liberales artes*, however, is not yet fixed and used.

VII.

Following Alcuin in the next generation and extending his influence came Theodulfus and Rabanus Maurus, who is really the first *praeceptor Germaniae*. About A. D. 820 Theodulfus wrote a poem, describing the seven arts allegorically, entitled *De Septem Liberalibus in quadam Pictura Depictis* (Migne C V. 333). About A. D. 819 comes the *De Clericorum Institutione*, the famous work of Rabanus Maurus, containing his views on education. In the third book of this treatise, he opens the eighteenth chapter with the words *Prima ergo liberalium artium est grammatica*, and proceeds to describe each of the seven. After completing the description he opens the next ensuing chapter (the twenty-sixth) with the retrospective words, *Ecce de septem liberalibus artibus philosophorum*, etc. This is the first instance of *septem artes liberales* which I can find. Later in the Middle Ages it is of course abundant to excess.

VIII.

The points made clear are these:

(1) The older expressions, *artes liberales*, *studia liberalia*, *litteræ liberales*, and others like them, were expanded by prefixing *septem* under the influence of Christianity, and the chief of these expressions is *septem artes liberales*.

(2) The change was in progress from the time of Cassiodorus (A. D. 560) to the time of Rabanus Maurus (A. D. 819), or about two centuries and a half.

(3) The considerations which brought about this change in the expression are concurrent with the increasing favorable regard shown by Christian writers to the studies of the ancients, as contrasted with the extreme antagonism of earlier centuries.

(4) The Christian justification of this regard has a progressive development. In the fourth century Augustine and Jerome allow liberal studies because they contribute to the knowledge of Scripture. In the sixth century Cassiodorus argues for the arts because of the Scriptural significance of their number,—seven. At the close of the eighth century Alcuin boldly makes it a matter of Scriptural exegesis. Augustine finds the liberal arts helpful toward knowledge of Scripture, Cassiodorus finds in their Scriptural number a mystical hint of their excellence, and Alcuin boldly gets them out of Scripture. Along with this progressive showing of favor to the arts as subjects for Christian study, we find the nomenclature working toward definite fixity of expression, and by the ninth century the pagan *artes liberales* are fully metamorphosed into the Christian *septem artes liberales*.

MEASUREMENT OF THE COEFFICIENTS OF EXPANSION OF GLASS AND PLATINUM.

By SAMUEL T. DODD,
ASSISTANT IN PHYSICS.

The following measurements were made, in the Physical Laboratory, during the latter part of last May and the early part of June, in order to obtain the relative coefficient of expansion of certain specimens of glass and platinum.

The bar to be measured was enclosed in an iron pipe through which a current of steam could be passed. The ends of the bar, projecting from the pipe, were the points from which measurements were taken. The pipe was enclosed in a box packed with excelsior to prevent loss of heat from the steam surrounding the bar; and the whole apparatus could be laid under the microscopes of a comparator, and the length of the bar measured by comparison with a standard metre scale. After the length had been measured a current of steam was passed through the iron pipe, surrounding the bar, and its expansion measured by the micrometers fitted to the microscopes. After steam had been shut off the contraction was read in the same way.

In order that the glass and platinum might be submitted to the same conditions of temperature and measured simultaneously, the platinum was prepared in the form of a small wire of 0.25 mm. in diameter, and the glass, in the form of tubes with a base which would just admit the wire. At one end the glass and platinum were sealed together by melting the tip of the glass tube in a blowpipe flame. All difference in expansion, therefore, took place at the other end and could be measured on one micrometer.

In calculating the coefficients from the expansions, measured in this way, two corrections were taken into account. One was a correction for the expansion or contraction of the bed-plate of the comparator, which, as the temperature of the room changed, increased or diminished the distance between the microscopes. The other was due to the fact that the whole length of the bar of glass and platinum did not lie in the steam. In this way some fifteen different measurements were made which agreed fairly well with each other. One peculiarity of the results was that the coefficient of the platinum, as

calculated from the expansion was invariably greater than that calculated from the corresponding contraction. For this reason, in making up the averages the coefficients of expansion and contraction were added separately. For the glass, the averages of the coefficients of expansion and contraction were the same within the limits of error; but for the platinum, the averages of the coefficients of expansion and contraction differed from each other by an amount considerably greater than the probable errors.

It is possible, though it seems hardly probable, that this discrepancy was caused by an error of the thermometers, either on ascending or descending the scale of temperatures. What the results would seem to indicate, is that the platinum after being heated, from the temperature of the room to 100° C., and allowed to cool to its original temperature, would be found to have increased in length. If this is so it may be due to some sort of annealing process in the platinum or it may indicate a lag of the contraction behind the temperature analogous to the lag of magnetization behind magnetizing force usually known as "magnetic lag" or "hysteresis." The existence of this *thermal hysteresis* would explain one or two other discrepancies in the results, which must otherwise be referred to errors, either of measurement or of thermometer indications. To decide these questions, however, would necessitate a more extended series of experiments.

The mean of the coefficients now obtained gives the following result.

Average coefficient of expansion of platinum,
between 25° and 100°C. 8.6170×10^{-6}
Probable error, $\pm 0.0343 \times 10^{-6}$

Average coefficient of contraction of platinum,
 8.4100×10^{-6}
Probable error, $\pm 0.0645 \times 10^{-6}$

Average coefficient of expansion of glass,
 8.0033×10^{-6}
Probable error, $\pm 0.0251 \times 10^{-6}$

Average coefficient of contraction of glass,	8.0153 $\times 10^{-6}$
Probable error,	$\pm 0.0536 \times 10^{-6}$
Ratio of coefficients of expansion,	1.0785
Probable error,	± 0.0059
Ratio of coefficients of contraction,	1.0457
Probable error,	± 0.0035

OBSERVATIONS OF ATMOSPHERIC ELECTRICITY.

By W. F. MAGIE.

During the spring of this year a series of observations of the electrical state of the atmosphere, taken in connection with the prevalent meteorological conditions, was made at Princeton by Mr. John Zimmerman, of the graduating class. The observations were arranged and tabulated by Mr. Zimmerman and were put at my disposal for discussion.

The instrument used in the observations was a Thomson's portable electrometer, having a constant of 2.54 volts for one division on the head of the micrometer screw. The collector was an alcohol lamp of the sort used for heating water, etc., in which the flame is formed over a surface of wire gauze. The large flame of this lamp proved very efficient as a collector, and could be used without any shield or chimney, even when the force of the wind was considerable. The lamp was carried on an ebonite rod, mounted on a bamboo pole shod with an iron point, so that it could easily be planted in the ground. Connection was made by an insulated wire from a copper wire set in the flame to the electrometer.

The observations were all made at the same spot, in the centre of an open field.

A study of the records confirms the results obtained by Exner and others with regard to the influence of humidity on the potential of the atmosphere. There is no regular sequence in the observations, showing a consistent increase of potential differ-

ence with a decrease of the quantity of water vapor in the air, but when those observations are selected in which the sky was comparatively free from cloud, and arranged in the order of the potential differences found, it appears at once that the greater potential differences occur in company with the smaller quantities of water vapor.

A noticeable connection exists between the wind velocities and cloud recorded and the potential differences. Speaking generally, the potential is less when the sky is cloudy than when it is clear, and is greater when the wind is blowing than when it is calm. The effect of the wind is very noticeable in some cases in which the wind sprang up or increased between two observations. In four out of five such instances recorded a marked rise of potential took place. When the wind is blowing the effect of the clouds in diminishing the potential differences seems to be less marked. On cloudy days with wind, the potentials have often as large values as on clear still days.

Mr. Zimmerman has called attention to a very marked difference between the potentials measured at two o'clock in the afternoon and at seven o'clock in the evening. The evening potentials are much lower than those obtained in the afternoon. From a number of observations taken under normal conditions of weather, Mr. Zimmerman computes for a rise of one metre an average potential increase of 9.3 volts at two o'clock and of 3.6 volts at seven o'clock. This result is in accord with the observations of Exner, and with the recent work of Elster and Geitel.

Only one case of negative potential was found, and the potential difference was very slight. It was observed during a fog with no wind. One evening, after a thunderstorm and just before a fall of rain, a positive potential difference was observed of 160 volts per metre.

ARCHITECTS OF THE MEDIAEVAL
ROMAN SCHOOL.

By A. L. FROTHINGHAM, Jr.

Three previously unknown architects of the XII. and XIII centuries are here made known and their signed works illustrated. The first is *Martinus* who signed his name to the porch of the church of S. Erasmo at Veroli in the southern states of the church. The inscription, in letters of about 1150, reads as follows: *Est manibus factus Martini quem probat arcus*. The porch is of three round arches of massive style and delicate decoration and is of the same general type that is seen at Casamari, Piperno, Casauria, etc., but somewhat earlier and purely Romanesque in style with some classic details. Such porches are extremely rare. The second architect is named *Grimuhaldus* and his work is the crypt of the cathedral of Sutri, a remarkable construction of the XII. century with sixteen small apses arranged systematically around the four sides. He signs himself: *Grimuhaldus presb(yster) accol(it)a*, and is one of the few non-secular mediæval artists of this period who have left their names on monuments in the Roman province. The crypt is one of the most interesting and carefully constructed in this region. The third name is that of *Petrus Gulimari de Piperno* who, with his two sons built the church of S. Lorenzo Amaseno and finished it in the year 1296. These architects belonged to the Cistercian school, and were doubtless brought up in the methods and style of the architects of the monastery of Fossanova situated at a distance of only a few miles. The style is an exact imitation of Cistercian work and imitates quite slavishly a style that had gone out of date seventy years before.

[Abstract of a paper published in the *American Journal of Archaeology*, vol. VI, No. 3.

THE INTRODUCTION OF GOTHIC
ARCHITECTURE INTO ITALY.

II.

THE MONASTERY OF S. MARTINO.

By A. L. FROTHINGHAM, Jr.

This article continues the demonstration of the introduction of Gothic architecture into Italy by the French Cistercians at the close of the XII. century, already begun in detail in a previous article on the monastery of Fossanova (see BULLETIN I, 1, 4; II, 3). The monument here illustrated is S. Martino on the *Mons Ciminius*, a few miles from Viterbo in the northern States of the Church. It was an early Benedictine foundation and had fallen into complete decay. In 1207 a colony of monks was sent there from Pontigny in France (Burgundy), its prosperity returned and magnificent buildings were erected under the patronage of Pope Innocent and Cardinal Rainerio Capocci. They have been sadly mutilated, especially through the building within the monastic precincts, of the Pamplili palace in the XVII. century. The greater part of the church, the chapter-house and part of the monastic buildings remain, and illustrate another phase of early Gothic than that embodied in Fossanova; it is lighter and more delicate and in its general style more in conformity with that of the transitional buildings of the Ile-de-France.

[Summary of a paper published in the *American Journal of Archaeology*, vol. VI, No. 3.]

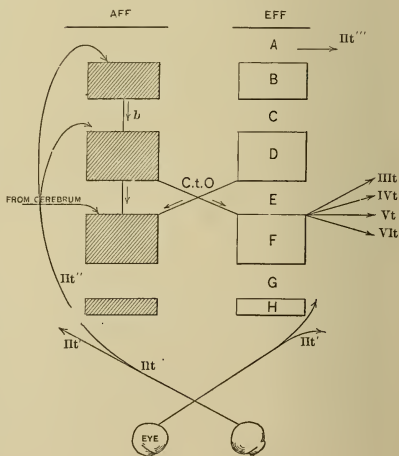
ORIGINAL RESEARCH IN THE MORPHOLOGICAL LABORATORY.

The recent consecutive studies of Prof. Osborn and Dr. Orr upon the brain of the amphibians and reptiles, suggested the idea of undertaking, in this Laboratory, a series of related investigations by Fellows and other advanced students—in preference to the choice of miscellaneous subjects for research. The nervous system is still a largely unexplored territory and

the unity of plan in brain architecture among the vertebrates renders every new fact, gained by the comparative method, of direct value in its bearing upon the human brain. This plan has resulted very well, since each investigator has profited by the experience and material gained by his predecessor, without any repetition of his work. The main lines of the researches have naturally been in the three branches of *a*, embryological development, as a key to ancestral history; *b*, comparative development, showing the evolution of the different centres of the brain; *c*, histological structures, including the distribution of the nerve tracts and cells.

The series of papers thus far completed or projected are the following: No. 1, The Internal Structure of the Amphibian Brain, by Prof. Osborn. No. 2, The Embryology of the Lizard, by Dr. Henry Orr, University Fellow. No. 3, The Development of the Amphibian Brain, also by Dr. Orr. No. 4, The Internal Origin and Peripheral Distribution of the Cranial Nerves, by Mr. O. Strong, University Fellow; (not yet completed). No. 5, The Medulla Oblongata of the Amphibia, by Mr. A. M. Miller, University Fellow; (not yet published). No. 6, The Primitive Segmentation of the Vertebrate Brain, by Mr. C. F. W. McClure, E. M. Fellow. No. 7, The Origin of the Cerebral Cortex and the Homologies of the Optic Lobe Layers in Lower Vertebrates, by Mr. I. Nakagawa. No. 8, The Primitive Segmentation of the Vertebrate Brain, Part II, by Mr. B. J. Waters; (not yet published). No. 9, The Comparative Structure and Relations of the Optic Thalami, by Mr. H. R. Pemberton, University Fellow; (not yet completed). Number 3 appeared in the *Quarterly Journal of Microscopical Science*, all the other completed papers have been pub-

lished in the *Journal of Morphology*. The July number of this Journal contains Nos. 5 and 6. Mr. Nakagawa's paper describes an ingenious and partly successful attempt to determine the relations of the numerous alternating layers of fibres and cells which compose the cortex of the Optic Lobes. He first demonstrates that these layers are homologous throughout the vertebrates, differing only in thickness and in their minute structure; beginning with the optic lobes of the Frog which are fairly typical, he observes a remarkably slight advance upon their structure in the higher forms as compared with the rapid development of the cortex of the cerebrum. There follows from this the interesting discovery that it is quite possible to ascertain by the comparative method the relations which each of these eight layers have to each other and to the surrounding parts of the brain. He has partly succeeded in determining these highly complex relations, expressing his general conclusions in the following diagram:



The optic nerves, II_t, pass into the outer fibre layers, A & c, then into the cell layers, B & D. From E pass tracts leading probably to the visual centres of the cerebrum, while F is the cell layer from which arise at least two of the nerves, III_t & IV_t, which control the motions of the eyeballs. These original results need to be verified by more extended research, but are of very great suggestive value.

Mr. McClure's paper continues a line begun by Dr. Orr and which is being completed by Mr. Waters. His object is to demonstrate that there were a definite number of segments, or neuromeres, in the primitive brain, corresponding to segments in the lateral muscle plates, each giving off a motor-sensory nerve. This he proves is the only safe method of determining the primitive structure and innervation of the head region—of great importance in connection with the problem of the origin of the vertebrates. He shows pretty conclusively that the total number of primitive segments was ten (six in the hind-brain, two in the mid-brain, and two in the primary fore-brain,) and that these segments are continued through the spinal cord, so that the entire primitive neuron is a segmented structure suggesting the segmented nerve-cord of the annelids. His researches include the Amphibia, Reptiles and Birds. Mr. Waters has carried the investigation into the Fishes and already has largely confirmed and added to these results.

*OBSERVATIONS OF COMET 1889 V AND
INVESTIGATION OF ITS ORBIT,
WITH AN EPHEMERIS.*

By DAYTON C. MILLER, D.Sc.

Seldom has a problem so complicated, requiring such an extended research, and of such extraordinary interest, been presented to the student of mathematical astronomy as that offered by the fifth comet of the year 1889, through the im-

portant discovery of Mr. S. C. Chandler. Upon computing the orbit of Comet 1889 V, discovered by Mr. W. R. Brooks on July 6, Mr. Chandler found that it passed very close to Jupiter in 1886, and that its orbit was at that time radically changed. The incomplete investigation of the orbit before this encounter led to the identification of this comet with the famous Lexell's Lost Comet of 1770.

The Comet of 1770 was found by Lexell to be moving in an elliptic orbit with a period of about five and a half years. It had never been seen before, and at the computed times for its subsequent returns it could not be found. These difficulties were accounted for by supposing that in its near approach to Jupiter in 1767, the attraction of this planet had changed its orbit from a large one into the small one in which it was moving in 1770, and that in 1779, when again very close to Jupiter, its orbit was again changed so as to render the comet invisible from the earth.

Comet 1889 V was visible from the time of its discovery till about the middle of March, 1890, when, having become very faint, due to increasing distance, it was impossible to observe it longer as it passed into the region of twilight. After a few returns to visibility the comet will again become subject to Jupiter's influence. To determine the theory of its motion so as to calculate Jupiter's action and obtain definite results respecting its mass and other physical properties is now the interesting problem. The comet was observed by the writer with the 23-inch Equatorial of the Halsted Observatory, Princeton, on every favorable occasion from Nov. 14 to its final disappearance, it being last seen on March 18. On each night the comet's place was determined by making a number of differential comparisons, using a square-bar micrometer, between its position and that of a near star whose place is known from star-

catalogues. The results of these observations are given in the paper and were also published in the *Astronomical Journal*, Nos. 207, 212, 216.

The following items are taken from the notes on the observations. On Nov. 14 and 15 one of the four companion comets discovered at the Lick Observatory was seen, but not well enough to admit of observation with the micrometer. The large comet had a short bushy tail which was visible to the last. On December 13 the comet was observed to pass directly over a small star, the star being seen when very close to the nucleus of the comet, the latter appearing as a double star. It would thus seem that the comet was sensibly transparent with, perhaps, the exception of the small nucleus. In March it was difficult to distinguish a nucleus, the comet appearing as a faint diffuse patch of light.

Parabolic elements are given, computed from observations made on November 16, December 16 and January 16, using the formulæ as developed by Oppolzer. These elements fail to satisfy the observations, the discrepancies being very large.

Approximate elliptic elements are then obtained, and with these the observations are corrected for all errors, and the several observations made in November, December, January and February, are combined into normal places for four dates separated by equal time intervals, with which to make a better determination of the orbit. The normal *true* places of the comet, all referred to the equator and mean equinox of 1890.0, are:

G. M. T.	α	δ
Nov. 15.5	356° 57' 44".92	— 0° 40' 2".4
Dec. 15.5	4 26 45.89	+ 4 13 30.9
Jan. 14.5	15 27 23.56	+ 9 47 5.3
Feb. 13.5	28 23 4.92	+15 17 16.5

Using the last three normal places, elliptic elements are given computed by

the formulæ as given in Watson's Treatise. The orbit is also computed from the first three normal places, using Oppolzer's method. This method for determining an orbit from three observations is to be preferred to Watson's both on account of the much better arrangement of the formulæ for rapid and accurate calculation and because much less labor is involved in the successive approximations for the radii-vectores. The results of the computation are the following

ELEMENTS.

I = 1889	Sep. 28.27186	G. M. T.
π =	0° 44' 27".77	} 1890.0
Ω =	18 5 55.67	
i =	6 4 2.23	
ϕ =	27 15 38.18	
$\log a$ =	0.5537124	
$\log m$ =	2.7194381	
P =	6.7697 yrs.	

These elements must exactly represent the two extreme places, and if we compute the middle place, its agreement with the observed value will show the accuracy with which the elements satisfy the given observations. The differences between the observed and computed longitudes and latitudes are,

$$d\lambda_{\parallel} \cos \beta_{\parallel} = + 0''.15, \quad d\beta_{\parallel} = + 0''.01.$$

An ephemeris is given, computed from the above elements, covering the periods of visibility in January, February, and March. Comparing the ephemeris place for February 15.5 with the normal place for the same date, the differences are found to be,

$$da = + 1''.01, \quad d\delta = + 4''.9.$$

Though the elements do not wholly satisfy these subsequent observations, yet the differences are not larger than might be expected considering the nature of the observations, and the fact that the path of the comet was very nearly the arc of a great circle. The given elements are the best obtainable from the observations by the three-place method. It would be desirable

to compute the orbit using the four normal places. The investigation of this orbit is incomplete and is reserved for future consideration.

The definitive elements of the orbit are to be obtained only by correcting the osculating elements, using a long series of observations, and by taking into account the various perturbations. The problem then becomes exceedingly complicated and laborious.

[Abstract of Thesis submitted for the degree of Doctor of Science, June, 1890.]

DE COUBERTIN ON AMERICAN UNIVERSITIES.

Among other instruments for the reform of education in France, there exists a society whose object it is to introduce into French schools and universities something of the athletic life found among students in America and England. The president of this Society is Jules Simon, the secretary Pierre de Coubertin. A year ago the latter was sent out by his government to examine and report upon the nature, tendencies and development of out-door sport in American Colleges. This report is now before us in an entertaining and instructive volume entitled *Universités Transatlantiques*. The duration of his journey was only three months and in that time he travelled from New York to Chicago and from Quebec to New Orleans. Nevertheless, being, as he evidently is, a trained observer and having a thorough command of the English language, there is nothing superficial in his report and many of his remarks show a profound insight into our social conditions. He finds in general an established civilization, a well constructed society and, above all, powerful traditions working out a gigantic problem. Everywhere he has however the sensation of incompleteness. Men and things have an unfinished air,—but the process goes on, gaps

are filled, institutions are better adapted to their ends. To use his own metaphor, the American bestrides a fiery steed which to the careless world he seems to ride merely for display; in reality he is little by little and surely reducing it to perfect subjection by consummate tact and prudence. The race-problem in the South is discussed in a spirit of candour and justice with an evident conviction that a few generations will set the negro on a plane of intelligence and culture not far below that of the whites. The studies of the nature of Roman Catholicism in the United States and of the Christian basis of all our institutions are very instructive and attract attention by their evident importance to the writer's mind. The last chapter in the book is an appeal for the introduction into the French schools of the study of the history of America with its short and splendid past, its glorious promise, its lessons of patriotism and its examples of manhood and energy.

The remarks of the author about the character of American education are necessarily scattered and disconnected. He observes with regret the paucity of secondary schools which form the indispensable middle story between the primary and higher grades of learning. Noting the transformation of the older and larger colleges into universities, he failed to understand that there are still many colleges which remain true to their origin and furnish an admirable secondary education. But the courses of study marked out respectively for schools, colleges and universities seemed admirable if only the programme were thoroughly and conscientiously carried out. Of this he had of course little or no means of judging, but he seems to have felt the generally existing gap between school and university work, more noticeable in institutions where the entering student has little or no guidance in choosing studies suited to his

wants, and where no provision is made for his deficiencies. In the matter, however, of character and traits peculiar to each of the institutions he visited, there is always keen insight and his remarks, biting and sarcastic as they often are, deserve to be carefully pondered. For example, he finds much to admire in Princeton and many commendable traits in its work and students, but he has some stinging and wholesome remarks about our lack of style and distinction in carriage, manners and dress. He is good-natured enough, or ignorant enough, one or the other, to condone it as a national trait. Alas! we know there is no such excuse and that it is begotten in part by isolation, in part by a rather contemptuous irreverence and insouciant selfishness. It is characteristic neither of our national life, nor of the social rank to which we belong, either as students or teachers. Nor are we the ones to quarrel with the author when he says that on his return to Princeton, after the completion of his journey, he recognized that men like Princetonians were "the true Americans, the foundation of the nation, the hope of the future: that in them are incorporated the traditions of more than a century, old-fashioned good sense, moral vigor; that by them, in short, the present is firmly knit with the past and prolongs it."

Of course we are so familiar with our own athletic systems that we need not follow M. de Coubertin in his account of them or in the analysis of their development and tendencies. He sharply distinguishes between the physical training and scientific anthropometry of Dr. Hitchcock's system and the spontaneous sport of out-door games under student management. The former is, justly we think, the butt of his wit and the burden of his denunciation, making as it does an automaton of the athletic director, depriving exercise of its natural quality of amusement, and, most important of all, closing

for the young the natural outlet for their organizing powers. It is, however, a matter of the utmost interest and gravity that such importance is attached by him to the out-door life and sport of American youth because of its perfect liberty. The gymnasium and scientific physical training should exist along with it, but as distinctly subservient to it. The years spent at school and college are years of tutelage, of guidance, of obedience. Natural initiative is often so dwarfed in them that many educated men utterly fail in life to reach the position to which their abilities would otherwise entitle them. If there were no other reason to uphold the athletic tradition now rooted in our colleges, and there are many, this alone would be sufficient, that it produces will-power, organizing power and endurance amid surroundings not altogether favorable to those qualities.

PROVIDENCE AND SECOND CAUSES.

By PROF. G. MACLOSIE.

It was attempted to show that Science and Religion, so far from conflicting, confirm, and exercise a wholesome influence on each other. The existence of purpose in nature was shewn, cases of dysteleology examined, and laws of nature represented as instruments of Divine Providence. The problem of the mode of Divine operation through nature may be regarded as a more complex case of the problem as to the operation of our mind on our body and on the external world, which is conceded to be insoluble. The argument was applied to the cases of prayer, and its answer, miracles, secondary creation by means of evolution, and the origin of man.

[Abstract of a Lecture before the *Summer School of Philosophy*, at Avon, N. J., Aug. 11, 1890.

THE TESTIMONY OF NATURE.

By PROF. G. MACLOSKIE.

The early use of the terms *Nature* and the *Light of Nature* for human reason was considered, this being the only sense in which the word *Nature* was used in the older theological formularies. Its scientific use, and the bearing of modern research were discussed, and attention directed to the silence of the Westminster Assembly as to the Copernican controversy which at that date was under discussion. The "mixed" idea of nature, including Psychology and Physico-theology is responsible for offences that are charged against science. The application of such reasoning to the interpretation of Scripture, examined in the light of results, proves the general soundness of our scientific methods, and indicates the necessity of applying the inductive method in philosophy as well as in science.

[Abstract of an article in the *Presbyterian and Reformed Review*, October, 1890.]

FORMULÆ FOR INTEGRATION.

By PROF. G. MACLOSKIE.

The formulæ for integrating

$$\int^m (xa + bx^n)^p dx.$$

are reconstructed, reducing them from four to two in number, which are easier to be remembered and to be applied than the old formulæ. A method is also shewn of reducing to a single operation problems which have hitherto been solved by several successive applications of the formulæ.

[Abstract of an article in the *Annals of Mathematics*, February, 1890.]

THE PROBOSCIS OF THE HORNFY
(*HÆMATOBIA SERRATA*).

By PROF. G. MACLOSKIE.

This is a preliminary note on an insect which is causing trouble to farmers by its attacks on cattle. I find that the Horn-

fly is not provided with any poison-glands or sting like that which I discovered in the Mosquito. It has salivary glands like those of the House-fly, and a proboscis nearly like that of the House-fly, and this is protruded in the same way (by swelling with air by means of the tracheæ). The labrum, hypopharynx, and teeth are nearly as in the House-fly; but instead of the pseudotracheæ on the extremity, it has a system of duplex lanceolate scraping plates.

THE OREODONTIDÆ.

By W. B. SCOTT.

In this article the dental and skeletal structure of the various genera of Oreodontidæ is fully described and figured, so far as the known material will permit. As this material is very extensive, opportunity is given to reach fairly definite conclusions as to the mutual relationship of the various members of the group, and the connection of the family as a whole with other types of Artiodactyla, both recent and extinct. The result of the investigation is that the Oreontidæ present a peculiar "closed" series of forms which are not nearly allied to any existing group, but which developed independently from the generalized Eocene group of Buno-Selenodonts, and has died out without leaving any successors. The views which have been expressed by various naturalists that the oreodonts are connected with the pigs, camels, tragulines, etc., rest upon insufficient information.

[Abstract of a paper published in the *Morphologisches Jahrbuch*, Leipsic, vol. XVI, No. 2, pp. 319-395. Pl. XII-XVI.]

NOTES.

The Final examination of Mr. Wallace Torrey Chapin, A. B., Amherst, 1887, for the degree of Doctor of Philosophy was held in July. Mr. Chapin's thesis, entitled *Evolutionary Ethics* had been previously printed and approved. The examination

in Mental Philosophy, the chief subject, was conducted by Prof. Ormond. The examination in History, one of the subsidiary subjects, was conducted by Professor Sloane, and in Physiological Psychology, the second subsidiary subject, by Professor Scott. Dean Murray presided. Mr. Chapin sustained the examination successfully and was recommended to the Trustees for the Doctor's degree.

Mr. Clarence Dayton Miller, a graduate of Baldwin University, O., and a resident candidate for the degree of Doctor of Science, presented in May his thesis entitled "Observations of Comet 1889 V., and an investigation of its Orbit, with an Ephemeris." The thesis was accepted, and Mr. Miller's final examination took place in the Faculty Room, Wednesday May 28th. Professor Young examined in astronomy, the chief subject, and Professors Magie and Fine in physics and mathematics, the two subsidiary subjects. Mr. Miller sustained a satisfactory examination and was subsequently recommended by the Faculty for the degree of Doctor of Science in course.

The preliminary examination of applicants for the Doctor's degree was held according to law on Wednesday afternoon, September 24th, in the Faculty Room. President Patton presided. The following gentlemen passed the examination and were enrolled as candidates.

Mr. Howard Crosby Warren, A. B., Princeton 1889, Mental Science Fellow in 1889-90, Instructor in Logic in Princeton College, candidate for the degree of Doctor of Philosophy, with Mental Philosophy as the chief subject.

Mr. John Milton Brooks, A. B., Princeton 1889, Mathematical Fellow in 1889-90, Instructor in Mathematics in Princeton College, candidate for the degree of Doctor of Philosophy in Science, with Mathematics as the chief subject.

Mr. N. C. James of Halifax, Nova Scotia, A. B. Toronto University 1883, with Honors, candidate for the degree of Doctor of Philosophy, with Political Philosophy as the chief subject.

Mr. John Irenæus McCaine, A. B. Erskine College, S. C., candidate for the degree of Doctor of Literature, with English as the chief subject.

Mr. Fred. Neher, A. B. Princeton 1889, candidate for the degree of Doctor of Philosophy in Science, with Chemistry as the chief subject.

Mr. William Cowper Prime, 2d, A. B. Princeton 1890, candidate for the degree of Doctor of Philosophy in Science, with Biology as the chief subject.

In addition to these Mr. E. A. Bechtel, A. B. Johns Hopkins 1888 and University scholar at Johns Hopkins 1888-89, was entered as a candidate on July 8th. Mr. Bechtel applies for the degree of Doctor of Literature, with Latin as the chief subject.

The whole number of candidates for the Doctor's degree at the present time is seventeen, eleven being resident and six non-resident. The chief subjects of study are as follows:

Department of Philosophy:

Mental Philosophy	3
Political Philosophy	4

Department of Literature:

English	1
Greek	2
Latin	1
Modern Languages	1

Department of Science:

Mathematics	1
Astronomy	1
Chemistry	1
Biology	2

The examinations for the Stinnecke Prize were held in October in Dickinson Hall. Ten candidates presented them-

selves. After the examination was concluded, the papers were forwarded to the committee of judges. The committee consisted of the following alumni of the college:

Professor B. B. Warfield of Princeton Theological Seminary, Chairman; Professor W. A. Robinson of Lehigh University, (Stinneke Prizeman in 1881); Mr. C. R. Williams, of New York; Dr. J. W. Kershaw, of Germantown, Pa.; Mr. J. Leverett Moore, of Johns Hopkins University.

By unanimous report of the judges the prize was awarded to Mr. Jesse B. Carter, of New York City. The contest was the most vigorous known since the establishment of the prize.

The following is a statement of the new courses offered this year.

In the Junior and Senior Elective in advanced Logic, Mr. Warren gives an Alternate Course on Symbolic Logic and the Theory of Probability.

Professor Woodrow Wilson gives in the Junior and Senior Elective, as alternating courses: Public Law, General Jurisprudence, American Constitutional Law, International Law. His Senior Elective is Administration and English Common Law as alternating courses. Professor Wilson also gives two courses in Political Economy. One, the elementary course, is a Junior Required; the other, the advanced course is a Senior Elective.

In Archaeology and the History of Art, Professor Marquand announces courses in Greek Sculpture, Greek Industrial Arts, and Greek Mythology in Art; and Professor Frothingham, in Christian Architecture, and Mediæval Industrial Arts.

Mr. Harper offers a course in Italian as a Junior and Senior Elective.

In Mathematics, Professor Fine and Dr. Thompson offer a University Course in Elliptic Functions.

In a Junior and Senior Elective, Professor Scott offers alternating courses in Physical Geology and Historical Geology.

The following articles by Prof. Hunt have recently appeared:

(1) "Langlande, the Satirist," in the *Homiletical Review* for May.

(2) "Unsettled Problems in English Philology" in the *New Englander* for June.

His edition of "Caedmon's Exodus and Daniel" has reached a fourth edition; the "Principles of Written Discourse" a third edition, and "English Prose and Prose Writers" a second edition.

The following new appointments have been made since the appearance of the last College Catalogue.

Woodrow Wilson, Ph.D., LL.D., Professor of Jurisprudence and Political Economy.

William Francis Magie, Ph.D., Berlin, Professor of Physics.

Howard Crosby Warren, A.B., Instructor in Logic.

John Milton Brooks, A.B., Instructor in Mathematics.

Louis Eugene Livingood, A.B., Instructor in French and German.

Robert Hezekiah Beattie, A.M., Instructor in Latin.

Robert William Blake, A.M., Instructor in Greek.

Clarke Benedict Williams, A.B., Instructor in Mathematics.

Ernest Cushing Richardson, Ph. D., Librarian.

The number of students enrolled for the current year is as follows: Academic Department, Seniors 7, Juniors 10, Sophomores 13, Freshmen 155, Specials 29; School of Science, Freshmen 76, Specials 15—total, 304. The register of graduate students has not yet been made up.

The degree of Doctor of Literature has been conferred upon Professor Hunt, by Rutgers College.

The following new prizes have been founded since last year:

The C. O. Joline Prize in American Political History. A prize of fifty dollars to that member of the Senior class who shall pass the best examination in the Political History of the United States, during the period 1787-1820, and write the best essay on a designated subject connected with that period.

The Class of '70 Junior English Prizes. Of the yearly interest of \$1,500, one-half will be given to the best Anglo-Saxon scholar, and one-half, to the best English Literature scholar of the Junior Academic Class.

The Class of '70 Sophomore English Prize. This prize, the yearly interest of \$1,000 will be given to that member of the Sophomore Academic Class who, at the close of the Sophomore year, shall pass the best examination on the English studies of the year.

Formerly the Boudinot Historical Fellowship, amounting to \$200, was awarded to that member of the Senior Class who wrote the best essay on a given theme and passed the best examination on a given subject. The conditions of this Fellowship have been altered as follows: — The sum of \$400 per annum, to be paid quarterly, will be given to the holder of the fellowship, who shall be appointed by the Faculty, upon the nomination of the President and the Professor or Professors of History for any period not exceeding three years, on condition that he reside in Princeton and devote his whole time to historical research, that he deliver such lectures and conduct such exercises as the

President and the Professor or Professors of history shall direct, and that he perform such other duties as may be assigned him in accordance with the general regulations respecting the duties of resident Fellows.

The Frederick Barnard White Prize in Architecture has been thrown open to the entire Senior and Junior classes and to Special Students who take a full schedule of studies.

Professors Scott and Osborn are about to publish the second of their series of studies upon the White River and Loup Fork mammals, contained in the Museum of Comparative Zoölogy at Cambridge.

The expedition of 1877 obtained at Florissant, Colorado, a very large series of fossil plants and insects. The latter were submitted to Mr. Samuel Scudder of Cambridge, who has completed his studies upon the first instalment of the insects and will publish his results in a volume of the Hayden Survey which is shortly to appear. The collection is very greatly increased in value by having passed through Mr. Scudder's hands, and contains the types, in some cases the only types, of many of the new genera which Mr. Scudder has established. It has also been largely made use of for the plates in the volume mentioned. The Coleoptera still remain in Mr. Scudder's care.

As we go to press the death of Dr. Franklin C. Hill, Curator of the E. M. Museum of Geology, is announced. An obituary notice of this most faithful and efficient officer will appear in the next number of the BULLETIN.



FRANKLIN C. HILL

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. III.

FEBRUARY, 1891.

No. 1.

HISTORICAL DOCUMENTS.

THE FIRST CHARTER OF PRINCETON COLLEGE. A DISCOVERY.

It is well known that the present charter of the College, that of 1748, was preceded by an earlier one granted Oct. 22, 1746. President Maclean in his history (vol. I, p. 70), states that "neither the original nor any copy [of the first charter] is to be found." He gives a few facts regarding it, gleaned from various sources. But the whole account is meager.

By the kindness of William Nelson, Esq., of Paterson, Corresponding Secretary of the New Jersey Historical Society, the following additional information has been secured. It is contained in the following advertisements from the *Pennsylvania Gazette* of August 13, 1747, and according to Mr. Nelson's judgment is "a pretty full copy of the charter itself, merely omitting the purely formal parts." This excerpt from the "*Pennsylvania Gazette*" seems to consist of two parts.

1. An abstract of the First Charter.
2. Action of the Trustees.

"These are to give Notice to all concerned, That by His Majesty's Royal Charter for erecting a college in New Jersey, for the instructing of youth in the learned languages, and in the liberal arts

and sciences bearing date October 22, 1746, Messrs. William Smith, Peter Vanbrugh Livingston, William Peartree Smith, gent. and Messrs. Jonathan Dickinson, John Pierson, Ebenezer Pemberton, and Aaron Burr, ministers of the gospel, are appointed trustees of the said college; with full power to any four or more of them, to chuse five more trustees to the exercise of equal power and authority in the said college, with themselves. By virtue of which power, the said trustees, nominated in the charter, have chosen the Rev. Messrs. Gilbert Tennent, William Tennent, Samuel Blair, Richard Treat, and Samuel Finley, as trustees of the said college of New Jersey. Which trustees are by the said charter, constituted a body corporate and politick, both in fact and name, with full power to act as such to all intents and Purposes, and rendred capable of a perpetual succession to continue forever. By which royal charter, there is authority given to the major part of any seven or more of the said trustees, and their successors conven'd for that purpose, to purchase, receive, and dispose of any possessions, tenements, goods and chattels, gifts, legacies, donations and bequests, rents, profits, and annuities of any kind whatsoever, and to build any house or houses, as they shall think proper, for the use of the said college. And also by

the said charter is given to the major part of any seven or more of the said trustees and their successors, full power to chuse, and at pleasure to displace, a president, tutors, professors, treasurer, clerk, steward, and usher, with any other ministers and officers as are usual in any of the universities or colleges in the realm of Great Britain. And also by the said charter, is given to the major part of any seven of the said trustees and their successors, full power to make any laws, acts and ordinances, for the government of the said college, as are not repugnant to the laws and Statutes of the realm of Great Britain, nor to the Laws of the Province of New Jersey; provided, that no person be debarred of any of the privileges of the said college on account of any speculative principles of religion; but those of every religious profession have equal privilege and advantage of education in the said college. And also by the said charter, power is given to the major part of any seven of the said trustees and their successors, by their president, or any other appointed by them, to give any such degrees as are given in any of the universities or colleges in the realm of Great Britain, to any such as they shall judge qualified for such degrees; and power to have and use a common seal to seal and confirm diplomas or certificates of such degrees, or for any other use which they shall think proper.

"And these may further notify all con-

cern'd, that the said trustees have chosen the Rev. Mr. Jonathan Dickinson president, whose superior Abilities are well known, and Mr. Caleb Smith tutor of the said college, and that the college is now actually opened, to be kept at Elizabeth-Town, till a building can be erected in a more central place of the said province for the residence of the Students; that all who are qualified for it, may be immediately admitted to an academick education, and to such class and station in the college, as they are found upon examination to deserve; and that the charge of the college to each student, will be Four Pounds a year New Jersey money, at Eight Shillings per ounce, and no more."

It will be seen at once that an important contribution to the history of the college has been obtained. The names of eight of the twelve original trustees not given by Dr. Maclean are here mentioned, so that we know now all the first corporators. It appears also from the action of the Trustees, that the permanent site for the college had not been decided on. It was "to be kept at Elizabeth-Town till a building can be erected in a more central place of the said province for the residence of the Students."

It is not without interest to note that "the charge of the College to each Student, will be Four Pounds a year New Jersey money, at Eight Shillings per ounce and no more."

JAMES O. MURRAY.

NECROLOGY.

FRANKLIN C. HILL, *Sc.D.*

DIED NOV. 5, 1890.

In the death of Dr. Franklin C. Hill, Curator of the E. M. Museum, Princeton lost a valued officer who had been in the service of the college for sixteen years.

Dr. Hill never fully recovered from an attack of pneumonia some four years ago, and for two years he maintained a losing struggle between a strong will and failing bodily strength.

He was born in New York City, June 26, 1827. His father was an elder brother

of Dr. Thomas Hill, ex-President of Harvard College. His youth was passed in Philadelphia. At the academy there he used to recall as very popular instructors two Princeton men then fresh from college, Rev. T. L. Cuyler, and Prof. J. T. Duffield. Mr. Hill after taking a degree in Pharmacy spent some years in Tennessee. Later he moved to Cambridge, Mass., studied Engineering, and was engaged for several years in railroad work East and West. He ran the first levels over the Hoosac Mt. for the tunnel.

When Dr. Thomas Hill was called to the presidency of Antioch College, Yellow Springs, O., Mr. Hill became Curator of the College. He also at one time gave instruction in Science. During the Civil War he took service first in the Sanitary Commission and afterwards on the Engineer Corps,—when he had charge of the building of fortifications at Fort Jackson on the lower Mississippi. Mr. Hill helped to make the Ohio Geological Survey, and his reports make part of Vol. III of the record.

In the establishment of H. D. Ward, Rochester, N. Y., he learned the arts of working in plaster and of mounting skeletons, and for a time he was employed in setting up and exhibiting Ward's well-known collections of casts. In this capacity he first came to Princeton in 1874, and since that time he has been continuously identified with the E. M. Museum, mounting, arranging, and cataloguing its collections. The successive Princeton scientific expeditions to the Bad Lands of the West brought in plentiful new material, all of which passed through Mr. Hill's hands.

Mr. Hill possessed in a rare degree two natural gifts, which contributed to his success,—mechanical knack and a fine sense for form. In the manipulation and mounting of fossils he introduced new methods. Instead of exposing portions only of the fossils, leaving them in the

matrix, he patiently removed with needle-pointed picks the whole of the matrix; then, as necessary, cemented together disconnected parts in their natural places. The most unpromising heap of jumbled fragments under his eye and hand would come together as the substantial part of a skeleton. After cleaning, he mounted the fossils on pedestals—single bones as well as complete skeletons—in such a manner that they would rest in exactly the angular position which they had in nature, and with supports so ingeniously contrived that the specimen could be easily removed and taken apart for examination and study. Our collection stands unique in these features. [See Mr. Hill's paper on the Mounting of Fossils in the *American Naturalist Extra*, April, 1886.] Noteworthy specimens of Mr. Hill's mounting are the skeleton of the great deer-elk (*Cervalces Americanus*), the only one discovered, and the *Uintatherium* skulls.

Naturally Mr. Hill was proud of the Museum,—its rare fossils, which he had himself mounted, and its perfect arrangements which he had helped design. In his last days of weakness he was cheered by the praise given his works by a foreign scientist in the *Geological Magazine* of London. Mr. Smith Woodward of the British Museum in recounting his observations of American Museums singles out the mounting of the vertebrate specimens in the Princeton Museum for the very highest praise.

Mr. Hill possessed a wide range of scientific knowledge, which was largely self-acquired. His special fields were botany and entomology. He was a lover of nature, fond of out-door life, and a keen observer. This element of personal observation characterized Mr. Hill's knowledge whether of plants or insects or animals, and made his talks about them so racy and delightful, enriched with a fund of anecdote. It was a privilege to be his

companion in his walks afield. He occasionally contributed to the journals, when rarities fell in his way,—as his paper on the habits of *Meloe angusticollis*, in the *American Journal of Science*, February, 1883. He drew from nature a series of typical insects, greatly enlarged but scaled with scrupulous accuracy, to serve as wall-charts in entomological study, exhibiting all the parts of insects with their names. This valuable set was recently purchased for the College. Mr. Hill also excelled in black-board drawing, and occasionally gave illustrated public lectures.

His work did not bring him in contact with the students generally, but he made warm friends of all who came about him. In literature, Shakespeare and Burns were his common favorites. There are several younger members of the Faculty who will never forget delightful evenings in a certain student room in College where Shakespeare was read and discussed, and Mr. Hill recited Burns and throughout showed himself young as the youngest.

Two marked traits of Mr. Hill's character were his love of accuracy and exactness, and his hatred of all sham. He knew not the ways of diplomacy, and scorned to conceal his real opinions. Mr. Hill would sometimes sigh, deeming his life unproductive, regretting the disper-

sion of his efforts,—then a look at the paleontological section of the Museum would hearten him, for he recognized—justly indeed—that here he had made his mark, here was his monument.

The Trustees conferred upon him the degree of Doctor of Science in 1885.

S. R. WINANS.

FROM THE MINUTES OF THE PRINCETON SCIENCE CLUB, MEETING OF
JAN. 22nd, 1891.

Resolved: That the Princeton Science Club desires to express its deep feeling of loss in the recent death of Dr. Franklin C. Hill. He was one of the original founders of the Club in 1877, and was a constant and appreciative attendant until his sad decline in health a year ago. During two years he led the meetings of the Club, as its President, and lent to this office the dignity, kindness and warm sense of humor which always characterized him as a man, and which endeared him to his colleagues old and young. His contributions, from his specialties, Entomology and scientific methods of Museum work, were supplemented by frequent notes and remarks from his vast fund of information gathered by the life-long habit of close and intelligent original observation in the field. He was of the old school of American Naturalists, now so rare, presenting his facts with seriousness and humor in turn—and has left a gap in our ranks which can never be filled.

H. F. OSBORN,
C. F. BRACKETT,
H. B. CORNWALL,
Committee.

EDITORIAL NOTES.

EDUCATIONAL NOVELTIES.

It is singular that two educational reviews, the first of their kind in America, have been started almost simultaneously, in the month of January. The most comprehensive of the two is a monthly (10 Nos.), entitled the "*Educational Review*," which is edited by Prof. Nicholas Murray Butler, assisted by others, and is published in New York (Henry Holt). The January number has the following

papers: *The Shortening of the College Curriculum* by D. C. GILMAN; *Fruitful lines of investigation in Psychology* by WILLIAM T. HARRIS; *Is there a Science of Education?* by JOSIAH ROYCE; *The limits of State control in Education*, by ANDREW S. DRAPER; *The Herbartian School of Pedagogics*, I, by CHARLES DE GARMO. Then follow: discussions; editorials; reviews; foreign periodicals, etc. The number is a substantial one of 104 pages, and is well printed. It would be premature to express any criti-

cism as to its policy and character further than to suggest that at first glance it appears as if an attempt to cover the entire field, from the Kindergarten to the University, would result in heterogeneity that might impair the efficiency of such a review.

Of the second review only the announcement has come to hand. It is entitled "The Pedagogical Seminary," and is to be published three times a year under the editorship of President G. Stanley Hall of Clark University, Worcester. It aims at being an international record of educational literature, institutions and progress and addresses itself to laymen, such as trustees, legislators, editors and men of affairs who take an intelligent interest in education; to administrators, especially university and college presidents, and state and city superintendents; to professors of pedagogy and principals and teachers of normal schools.

On February 4th an event took place of considerable interest to Princetonians, the inauguration of the new president of Rutgers College, Professor Austin Scott. The president, *ex-officio*, of the board of directors, Governor Abbett, made the opening address and the formal delivery of the keys. The ceremony was dignified and interesting. Princeton was represented by Professors Hunt, Libbey, Murray, Rockwood and Sloane.

On February 7th the new Library building of the University of Pennsylvania was formally opened and this was made the occasion for a large gathering of guests invited by the Provost and Trustees of the University. Mr. Furness, chairman of the building committee, presented the Library to the University authorities and it was accepted in their name by Dr. William Pepper. The address was given by Mr. Tal-

cott Williams and his subject was *The Memory of Man*. The building contains not only books, which now number about 80,000, but also several collections, among others that of Babylonian antiquities made by Dr. Peters' expedition and that of Egyptian antiquities secured from the finds of Boubastis.

The new university which is being established in Chicago mainly in the interest of the Baptist denomination and with whose endowment fund the name of Mr. Rockefeller is prominently connected, will have as its president Dr. Wm. R. Harper. Dr. Harper is well known as the most prominent leader of the Chautauqua movement, as editor of *Hebraica* and other reviews and as professor of Semitic languages at Yale. If current reports are correct the new institution will be, in Dr. Harper's hand, an experiment of a novel character in pedagogical methods. It will not only encourage the popular sort of instruction that goes under the names of University and School extension and others of that ilk, but will aim at becoming a co-educational caravansary with a shifting staff and an unshackled student body. The following are reported to be the chief points in this scheme:

(1.) It will permit the admission of students to the University at several times in the course of the year rather than at one time only.

(2.) It will make it possible for good men to take the college course in three years and for poor men to have more than four years in which to do it.

(3.) It will permit men to be absent from the University during portions of the year.

(4.) It will make it possible for students to take, besides the regular studies of the college curriculum, such practical subjects as bookkeeping, stenography, and so on.

(5.) It will make it possible to avoid the necessity of retaining instructors in the institution when they have shown themselves incompetent.

(6.) It will make it possible for the University to use beside its own corps of teachers the best men of other institutions, both in this country and in Europe.

(7.) It will permit greater freedom on the part of both students and instructors in the matter of vacations.

(8.) It will allow large freedom in the choice of subjects, and yet so control this choice as to prevent fatal mistakes on the part of students.

*LECTURES AND SYLLABI FOR THE
UNIVERSITY EXTENSION.*

The executive committee of the faculty of University and School extension, including Presidents Dwight, Patton and Low and Messrs. Calkins, Harris and Seth Stewart, have made arrangements for the delivery in New York during the coming spring of fifty lectures divided into five courses. One of these courses is in art and archæology and these ten lectures will be delivered by Professors Marquand and Frothingham. The lecturers are to be mainly taken from Yale, Columbia and Princeton. This series of fifty lectures is the first practical attempt at carrying out the plans referred to in previous numbers of this BULLETIN.

Professors Brackett, Young and Libbey who are at the head of the departments of Physics, Astronomy and Physical Geography in the Faculty of University Extension, have already prepared syllabi of courses based upon their respective subjects which have been issued in the same series as some twenty of their associates.

PUBLICATION OF DOCUMENTS.

There is no college in America with a more splendid early record than that of Princeton, especially during the time of the Revolution. Though we recognize this fact, we have shown in the past but little zeal in the task of reconstituting in detail the records of this early period by collecting archives of contemporary documents. Such a collection has been begun. We have to thank Mr. J. Bayard Henry for this idea and for his energy in carrying it into

effect, and Mr. M. Taylor Pyne for continuing the work. We understand that there are already several hundred documents, including letters, accounts, memoranda and other records, the originals of which will be placed in the College Library where they will form the nucleus of a collection which should grow by the united efforts of alumni, trustees and faculty until it becomes a mine for the history of the College. It is to be hoped that some who will read this announcement and the documents here published may be able to make some contribution to this collection.

The BULLETIN is the proper medium for the publication of the more important of these documents and we begin with this number to issue what we hope will prove an uninterrupted series of papers of this character. This first document is, quite appropriately, a newly discovered synopsis of our first charter. Of the documents that are to follow there are some of considerable interest written by and to President Burr, or relating to the administration of this our second president.

THE NEW COMMENCEMENT HALL.

At the November meeting of the Board of Trustees a note was read from Mrs. Charles B. Alexander, announcing her intention to present to the College a Commencement Hall. It was a royal gift, and the heart of every Princetonian swells with pride at the thought of another stately hall upon our College grounds. We believe that the site has not yet been fixed, although three positions for the building are prominently mentioned as possibilities. One in a measure perpetuates the present situation, so that the new hall would either replace the First Church or the adjoining buildings or stand upon the open space in front of Witherspoon. Another site links the building with Whig and Clio Halls,

and its advocates speak of a porticoed Pantheon of white marble, in front of which succeeding classes would celebrate their graduating festivities. Others again look still farther ahead and would put the building behind David Brown Hall and thus establish a new centre, beyond which law and medical and other special schools may grow.

Speculation has also been rife as to the purpose the building may serve on other than Commencement occasions. This question will be determined in due time by the expressed wish of the donor.

Wherever the building may be located and whatever the purpose to which it may be applied in the long winter months, we have every assurance that in the new Commencement Hall we shall possess a fine architectural monument, which will add splendor to old festivals and in time give birth to new.

THE MEXICAN EXPLORATION PARTY.

In view of the fact that reports have appeared in various newspapers to the effect that this party is a Princeton expedition, it is but right that I should take the first opportunity to correct these statements, for they do injustice to the several societies and individuals, to which the Mexican expedition is due. The mistake may have been a natural one, from my connection with the College, but is none the less infelicitous.

The expedition originated in a conversation with Dr. Lumholtz, upon the occasion of our first meeting in November, 1889, at Watertown, Mass. At that time he was contemplating a trip to New Guinea, but after I told him of the many interesting problems in archæology, which awaited investigation in the Sierra Madres, he exclaimed, "I am going down there, and I want you to go with me." I told him that I was too much occupied at

the time to take part in a thorough investigation of the region, but promised all the aid in my power. To Dr. Lumholtz is due the credit of securing the large subscriptions which have made the expedition a fact. The plan of operations was presented to the American Geographical Society and the American Museum of Natural History of New York, and received their endorsement. These two bodies authorized us to say that we were working under their auspices, and they further showed their confidence in the scheme by subscribing \$1,000 apiece towards the funds of the party, which amount to \$20,000. The other subscribers are scattered all over the United States, thus making it a national party, rather than a merely sectional affair. As an officer of the first named Society, I should be far from claiming the credit for Princeton in the matter, since the College gave us no assistance whatever, except a general interest in the expedition, due to the fact of my connection with it.

Having now returned from a four months' trip with the party in Northern Mexico, I am glad to say that we have been successful in many lines of investigation. The work of the party was confined to the northern portions of the States of Sonora and Chihuahua. In this region about 700 miles were traversed and a good idea of the country was obtained. During the latter part of the time we were in a district which has probably never been visited by white men, and all the Indian trails were made years ago, and in spite of the prediction made before we went into this northern part of the Sierras, that we would find nothing of interest, it has turned out a very profitable field for study. We rather expected to pass through a mountainous region of as little value for archæological study as a desert, and were surprised to find evidences of its having been occupied at some time in the past by a

dense population. Extensive botanical collections have been made; a good collection of bird skins, and considering the locality, an excellent collection of minerals will be brought back. A series of over 400 photographic negatives has been taken, and they will fully illustrate all the field-work of the party as well as serve to give some idea of the grand natural scenery through which we passed. The results of the archæological work will be more interesting from the inferences to be drawn from the fragments found, and their bearing upon the discoveries made to the north, east and south of this region, than from the intrinsic value of the objects themselves. This is due to the fact, that from the nature of the ruins, it would be almost impossible to expect that any perfect specimens of pottery should be preserved, except under the most peculiar conditions; still enough was found to repay us amply for the time and trouble expended. Among

other things, a small Aztec idol was found much further north than they have ever been found before, and in such a place as leaves very little doubt as to its being upon the original site where its temple stood, although it had been used for other purposes, after the time of its discovery by the Jesuits while digging for the foundations of one of their churches. When I left, the party had reached the eastern slopes of the main Sierras, and their intention was to spend the next two months in the region about San Diego and Casas Grandes, and thoroughly explore the Piedras Verdes valley. They have therefore reached places which have already produced rich results under the hands of former explorers, although the region has been by no means exhausted. We shall consequently expect to hear of good results from their careful investigations.

WILLIAM LIBBEY, JR.

UNIVERSITY AND COLLEGE WORK.

THE COLLEGE ASSOCIATION OF THE MIDDLE STATES AND MARYLAND.

Four years ago the colleges of Pennsylvania formed an association for the purpose of discussing the many problems which they had in common. Such questions are the requirements for admission, the constitution of the curriculum, the character of the degrees conferred, methods of discipline, the relation of the colleges to the schools, to other colleges and to the country at large. The association flourished as a Pennsylvania association for two years, when it was thought desirable to enlarge the association so as to comprehend all the colleges of the Middle States and Maryland. The first convention of the enlarged association was held at the University of Pennsylvania in November, 1889. At this convention Prince-

ton was represented by Professor Henry F. Osborn, who read a paper on "Fellowships," and by Professor Allan Marquand, who read upon "College Students not Candidates for a Degree."

The second annual convention of the College Association of the Middle States and Maryland was held in Princeton, on Friday and Saturday, Nov. 28 and 29, 1890. The association met in Murray Hall, holding its sessions during the morning and afternoon of Friday and on Saturday morning. PENNSYLVANIA was represented by the following colleges: Allegheny, Bryn Mawr, Dickinson, Franklin and Marshall, Haverford, Lafayette, Lebanon Valley, Muhlenberg, Pennsylvania State College, University of Pennsylvania, Swarthmore and Ursinus. NEW YORK was represented by Columbia, Cornell, Colgate University, Hamilton,

Rochester University, St. Francis Xavier, St. Stephens, University of the City of New York and University of the State of New York. NEW JERSEY was represented by Princeton and Rutgers; DELAWARE by Delaware College; MARYLAND by Johns Hopkins University, St. Johns, Washington and Woodstock, and the DISTRICT OF COLUMBIA by the Catholic University, Columbian University, Georgetown University, Howard University and the National Deaf-Mute College. These institutions were generally represented by their presidents, who were accompanied in several cases by members of the faculties. The president of the Association, President C. K. Adams of Cornell, opened the exercises with an address upon the "Coordination of Colleges and Universities." The address was full of practical and almost revolutionary suggestions which elicited considerable discussion. Then followed a conference upon the shortening of the college curriculum in which the principal speakers were President D. C. Gilman, *pro*, President F. L. Patton, *contra*. President Gilman's remarks form the opening paper in the new *Educational Review*, January, 1891; those of President Patton are printed in the present number of the BULLETIN. Other papers were read by Professor Hughes of St. Francis Xavier on "Philosophy in American Colleges"; Prof. Stoddard of the University of the City of New York on "Inductive Work in College Classes"; Prof. Patten of the University of Pennsylvania on the "Measure of Culture-values in College Work," and Secretary Dewey of the University of the State of New York on the "Relation of the Colleges to the Modern Library Movement." After lunch at the Nassau Club, the exercises in Murray Hall were resumed. Provost Pepper opened the conference on "Methods of University Extension." His remarks are printed in the *University Magazine* for January, 1891.

He was followed by President Low, Mr. Wm. T. Harris, Secretary Dewey, Mr. Houston of Toronto, and others. Papers were then read by President Welling of Columbian University on "Problems in Higher Education," by Bishop Keane of the Catholic University of America on the "Idea and Scope of the Faculty of Philosophy," by President Seip of Muhlenberg College on the "Taxation of College Property," and by President Reed of Dickinson College on the "Place of the English Bible in the College Curriculum."

In the evening a reception was given by President Patton, when the delegates had further opportunity for individual conference and social intercourse. It was a noteworthy assemblage of distinguished educators, representing also many different phases of Protestant and Roman Catholic belief.

In the session of the following morning Dr. McCosh read a paper on the "Super-vision of College Morals and Religion," which has appeared in the *Princeton Press* of Dec. 20, 1890. Prof. Cooper of Rutgers read upon "How to Manage the College Student," and Prof. Schurman on "An Ideal College Education." All of these papers will be printed in due time in the regular PROCEEDINGS OF THE COLLEGE ASSOCIATION, a publication which promises to be of permanent value to the cause of education in this country.

The next meeting of the Association will be held at Cornell University, in November, 1891. It is expected that the Association will then be strengthened by the coöperation of a larger number of colleges from the State of New York. The following are the officers for the ensuing year:

President—President D. C. Gilman, Johns Hopkins University.

Vice-Presidents—President Seth Low, Columbia; Ex-President Edward H. Magill, Swarthmore; President Austin Scott,

Rutgers; President Albert N. Raub, Delaware; President Thomas Fell, St. Johns; Bishop John T. Keane, Catholic University.

Corresponding Secretary—N. L. Andrews, Colgate.

Recording Secretary—Secretary J. Y. Burk, University of Pennsylvania.

Treasurer—Prof. J. B. Kieffer, Franklin and Marshall.

Executive Officers (in addition to the above officers *ex-officio*)—Prof. H. S. White, Cornell, Chairman; Provost William Pepper, University of Pennsylvania; Prof. Oren Root, Hamilton; Prof. Allan Marquand, Princeton.

THE PHILOSOPHICAL CLUB.

The Philosophical Club is the outgrowth of the Library meetings, which under the last administration were an important factor in kindling an interest in philosophical studies. The Library meetings covered a wider range than purely philosophical subjects, secured large audiences of undergraduate as well as graduate students and devoted considerable attention to discussion. The Philosophical Club is more limited in scope. Its membership consists only of the Professors and Fellows of the Philosophical Department and of such as they may choose to associate with them. Meetings are held once a month, and there is usually an important paper read which finds its way into some philosophical or scientific magazine. Abstracts of these papers have frequently been printed in the BULLETIN. During the present College year the Club has already held four meetings. At the first meeting in November Dr. McCosh read a paper on Aristotle's Theory of Knowledge in which he treated the subject from the point of view of his recent book, entitled *The Prevailing Types of Philosophy*. At the same meeting Prof. Sloane discussed the subject of Pensions,

which he has elaborated in the *Century Magazine* for December. At the December meeting President Patton gave a comprehensive review of the recent literature on Theism; in January Professor Osborn discussed the Present Problem in Heredity, giving an outline of the arguments he delivered in Boston before the American Society of Naturalists, December, 1890, (published in *American Naturalist*, Feb., 1891); at the meeting in February Professor Scott gave a very interesting general account of the subject of Hypnotism. During the latter half of the year it is expected that the Fellows in the Philosophical Department will take a more prominent part in the presentation of papers.

PRINCETON BIOLOGICAL CLUB.

The increasing activity in the various departments of University work has been again exhibited by the formation of the Princeton Biological Club, thus adding another to the list of similar organizations in the College.

It is the aim of the Club to increase and concentrate the biological interests in the College, and the proceedings of the meetings, which shall fall regularly upon the third Thursday of each month, consist of reports of original work, stated papers and discussions upon subjects of biological interest and miscellaneous information in the Department of Natural History.

The membership of the Club includes three classes—Active, Associate and Corresponding. The former consists of persons connected with any of the Natural Science departments of the College. From and by this class the officers, consisting of a President, Secretary and Treasurer and an Executive Committee, are elected. Associate members are to be taken from the undergraduates of the College who shall show an interest in biological work.

Its monthly meetings are held in the Morphological Laboratory. The officers for the present year are: President, Prof. H. F. Osborn; Secretary, Dr. Walter M. Rankin; Executive Committee, Prof. W. B. Scott and Mr. A. H. Phillips. Prof. M. Allan Starr has been elected an honorary member, and eleven corresponding members have been elected from among graduates of the College who are engaged in Biology in different colleges of the country. The active members include the Professors, resident Fellows and University students, numbering nine this year. Fifteen associate members have been elected from the Junior and Senior elective classes. The meetings are conducted very informally in order to allow free discussion of the papers and original contributions which are brought before the Club.

The object of the corresponding membership is to sustain the interest of graduates in the work of the department. The associate members are allowed all the privileges of the Club except voting for officers and new members.

THE EXCAVATION OF DELPHI.

When allusion was made in a former number (Vol. II, No. 1, p. 13,) to the attempt then begun to raise a large fund with which to excavate the site of ancient Delphi in Greece, there seemed but a slight prospect of securing the necessary amount. In November, however, a great effort was made and \$77,000 were raised or pledged on the very date which the Greek Ministry had assigned as the ultimate limit of time. This amount is sufficient for the purchase of the village of Kastri which stands upon the site of Delphi. The Archæological Institute of America, through the exertions of whose officers and council the money has mainly been raised, has also voted the sum of about \$5,000, as a yearly contribution, for

the work of excavation. This work would be expected to last for quite a period of years, and to be entrusted to the School at Athens, which is a creation of the Institute. The negotiations with the Greek government for the purchase of the site are in charge of Dr. Charles Waldstein. For two reasons it is not yet certain that America is to have the honor of undertaking this excavation. In the first place Deliyanni has succeeded Tricoupi in the ministry and does not feel bound by his predecessor's promises; and, furthermore, the French chamber voted, some two months ago, a budget which included an appropriation of 400,000 francs for Delphi, and French influence is being brought to bear in order to obtain the same concession for which we are striving. We should also confess that France has a prior right, having undertaken the first investigations at Delphi nearly a half century ago.

Princeton is interested in the result, as she is not only one of the contributors to the School at Athens, but Professors Frothingham and Marquand have pledged a Princeton subscription of about \$1000 towards the fund. In December a meeting of the Council of the Institute was held in New York, at which Professors Frothingham and Marquand were present. Dr. Waldstein was appointed Agent of the Institute to carry on the negotiations.

THE JANSSEN PRIZE.

The French Academy of Sciences has this year bestowed the Janssen prize upon Professor Young, for his important discoveries in spectroscopy. The prize was founded quite recently by a distinguished French physician, M. Janssen. The decree authorizing the Academy to accept M. Janssen's gift dates from December, 1886, and the prize was first awarded in 1887. It consists in a large gold medal to be awarded for some important advance

in physical astronomy. Up to 1894 the prize is to be awarded annually, but afterwards biennially. Prof. Young's work in spectroscopy was begun over twenty years ago and, though discontinued of late, will be resumed with increased facilities as

soon as he receives the new spectroscope which is being built for him by Professor Brathear of Allegheny. The quick, ready acknowledgment of the value of Professor Young's work by the French Academy is extremely gratifying.

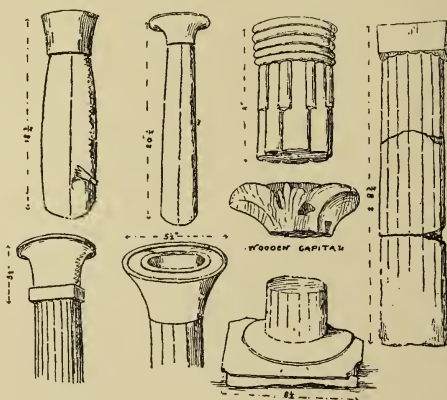
ORIGINAL CONTRIBUTIONS.

ARCHITECTURAL SIGNIFICANCE OF THE RECENT DISCOVERIES OF MR. FLINDERS PETRIE.

ALLAN MARQUAND

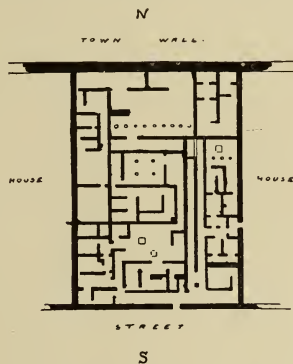
In the *Builder* for October 4, 1890, we find an account of Mr. Flinders Petrie's recent discoveries at the town of Kahun, on the borders of the Fayum, Upper Egypt. These are of great importance not only in presenting us with the ground-plan and architectural features of an Egyptian house of the XII. Dynasty (according to Bunsen's Chronology, about 2600 B. C.), but are of special interest in showing us the source from which were derived the general features of the Greek and Roman house. Without further detailed information than

we yet possess it would be rash to speculate too minutely upon the respective functions of the various portions of this somewhat complicated ground-plan. Nevertheless we cannot help being struck with the resemblance in many particulars with the plans of Pompeian houses. If we take as our key the general type of a Roman house given by Overbeck, *Pompeji*, p. 251, fig. 135, we may describe the Egyptian ground-plan in well known terms. From the outer *janua* we pass into the *vestibulum* and on into the *atrium*, where there is a basin or *compluvium*. The side chambers are the *alae* and one of the surrounding rooms, possibly, the *tablinum*. We pass then through the *fauces* into the *peristylum* which in this case is an *atrium tetrastylum*.



Beyond is the *xystus* or garden. Even the *hypogomæ* or cellar is not absent, supported by true "arches formed of two rings of headers." The apartments to the right, cut off by a solid wall from the remainder of the house, may have been the women's apartments and those to the left, the offices or stables, to which general disposition even closer analogies may be found in Homeric and Mesopotamian domiciles. The wooden capital and stone columns are also interesting as proto-Ionic and proto-Corinthian specimens dating from the XII. Dynasty. We cannot with the author of the article in the *Builder* recognize fig. 6 as a proto-Doric column, since we have already found in another class of columns of the same period much closer analogues (see Princeton College BULLETIN, 1889, p. 96). We have however in this column and in figs. 7 and 8 additional witnesses of the prevalence of channelled columns in Egypt during the XII. Dynasty. Nor can we with Mr. Petrie (*Academy*, 1890, April 5) regard fig. 10 as a capital of the "palm type," since the anthemion in the centre, as well as the strongly curved petals, allies this capital much more closely with the lotus flower capitals, which are known from Egyptian bas-reliefs to have existed in the V. Dynasty and to have been very prevalent during the XVIII. Dynasty (*Dieulafoy, L'Art Antique de la Perse*, Pt. III, pp. 31-80; *Goodyear, American Journal of Archaeology*, 1887, pp. 271 ff.). We see in it rather a proto-Ionic form, which develops variously in Mesopotamia, Central Asia Minor, Cyprus and the Greek Islands and finally assumes the canonical form of the Ionic capital. Even here it does not lose all trace of the central anthemion, which we may observe is never found in the capitals of the palm-leaf type. In fig. 5 we see a fragment of a reed-bundle column without its capital, whose neck is bound with heavy *annuli*, some trace of which is

left as an inheritance to the Doric capital. The remaining columns are of interest as specimens of proto-Corinthian columns, the inverted bell-shaped capital of which was usually decorated with carved and painted lotus flowers and which sometimes exhibited volutes at the four angles. This capital itself probably represents a conventionalized lotus flower or possibly the seed pod of the lotus. In figs. 3 and 4 it is represented as placed directly upon a bundle of lotus stems, whereas in figs. 7 and 8 it is transferred to a channelled polygonal shaft. The Greek and Roman Corinthian column was a mere modification of this type, the Greek acanthus being substituted for the Egyptian lotus. One further remark may not be out of place.



Inasmuch as the channelled shafts appear to have been frequently used at this period and as we find the proto-Corinthian capital sometimes upon a lotus-bundle and sometimes upon a polygonal channelled shaft, may we not suppose that the proto-Ionic capital was treated with the same indifference and that a capital of the form of fig. 10 might sometimes have been placed upon a shaft like fig. 6? This would afford an explanation of a peculiarity of the

Greek Ionic capital, namely its kymation. This appears as a band between the volutes of the capital and in the sixth century examples retains a reminiscence of the flat face of its Egyptian prototype, and was usually decorated with an Egyptian mæander. In later Ionic examples the kymation appears as a rounded torus moulding, but as if it wished to retain some sign of its Egyptian ancestry it is decorated with the "egg and dart," an ornament used by the Egyptians as early as the V. dynasty.

DESCARTES' GÉOMÉTRIE.

HENRY B. FINE.

It is the fate of Descartes' *Géométrie* to be extravagantly praised and little read. Mathematicians and the laity alike concede it the rank of an epoch-making book without taking the pains to inform themselves of its contents. As a consequence there have grown up in the course of time certain misconceptions regarding its style, methods, scope and spirit, such as cause one who chances to read the book many surprises, some pleasant and some disappointing. Its position in the history of mathematics also is generally only vaguely understood, Descartes' predecessors having the misfortune to be as little read as himself. This will be regarded, it is hoped, as sufficient reason for the appearance of the present brief account of the *Géométrie*.

Descartes' one great purpose in the *Géométrie* is to equip geometry with a general, and at the same time natural and simple, method of investigation. He had read the Greek geometry, especially Apollonius and Pappus, but could discover no such method there. To him each theorem of that magnificent collection seemed to have been discovered by an independent effort, each problem to have been solved by a method devised especially for it and applicable to it alone.

Descartes' first step is to put geometry in possession of the symbolism and powerful algorithm of algebra. "All problems of geometry," he declares at the outset, "can readily be reduced to such terms that one needs only to know the lengths of certain right lines to solve them." To these lines, thus made the elements of all geometric constructions, he gives "names" (*noms*) a, b, c , etc., to those which by the conditions of the problem are known, x, y , to those which are unknown. This device for distinguishing between known and unknown quantities, by the way, originated with Descartes. Vieta and Harriot had represented known quantities by consonants, unknown by vowels.

As all arithmetic can be resolved into five fundamental operations: addition, subtraction, multiplication, division, and the extraction of roots; so also, says Descartes, can the most complex constructions of geometry for determining the lengths of lines be resolved into five fundamental constructions: the construction of the sum of two given lines, say a and b ; of their difference; of a fourth proportional to an assumed unit line, a , and b ; of a fourth proportional to b, a and the unit line; and of a first, second, or higher mean proportional to the unit line and a . And since these constructions are formally "the same" as the arithmetical operations which correspond to them in the list just given, their results may be granted the same expression: viz., $a+b, a-b, ab, \frac{a}{b}, \sqrt{a}, \sqrt{Ca}$, etc.

It is to be noticed that this product ab is not, as in our modern "Cartesian" geometry, the numerical product of the lengths of a and b , nor yet as in the Greek geometry, the rectangle contained by a and b ; but a line. And in like manner $\frac{a}{b}, \sqrt{a}, \sqrt{Ca}$ represent lines. This point is especially to be insisted on since it is commonly said

that Descartes enriched mathematics with the concepts of the continuously variable number and the general irrational, which though he prepared the way for them are due not to him but to Newton and Euler. Descartes did not secure to geometry the advantages of the algorithm of numerical algebra by representing lines by their numerical measures. He rather created a new algebra, with fundamental operations subject to the same laws of combination as those of numerical algebra and, therefore, formally identical with that algebra. The *Géométrie* should be granted a distinguished place in the history of algebra; for it rests on the assumption—made only tacitly, to be sure,—that the fundamental characteristic of algebra is not its subject matter but the laws of combination to which its operations are subject. In no treatise before the *Géométrie* is this fact recognized. Its full significance never came to be appreciated until the discovery of two “algebras,” quaternions and the Ausdehnungslehre of Grassmann, in which one of the laws of numerical algebra, the commutative law for multiplication, had lost its validity.

Even a Greek mathematician might have used Descartes’ algebra without doing violence to his strict notions of the absolute separation of the discrete numbers of arithmetic and the continuous lines of geometry. Indeed the Danish mathematician, Zeuthen, by stating Apollonius’ *Conics* in Descartes’ symbolism, has made appear very probable what Descartes could not perceive, that the “great geometer” of the Greeks used just such an algebra as his instrument of investigation. The Greek, to be sure, would not have called the product ab a line, but a rectangle one of whose sides is the unit line; but Descartes is careful to explain that that is, strictly speaking, the meaning of his product.

The second book of the *Géométrie* opens with the inquiry: “What curved lines are

entitled to consideration in geometry?” “Any curve which can be described by a continuous motion or by a series of such motions of which each is entirely controlled by those which precede it,” is the answer. All the points of such a curve, Descartes continues, have necessarily a certain relation to the points of a right line, a relation which can be expressed by an equation *which is the same for all points of the curve*.

To obtain this equation he drops a perpendicular, y , to the line of reference and expresses the property by which the curve is defined in terms of y and x , the distance of y from a fixed point in the line of reference.

Descartes conceives of the coördinates x and y as *indeterminates* rather than as *variables*.

It will be noticed that he makes no formal choice of two axes of reference. He frequently calls the perpendicular to the line of reference, x , and the intercept, y . Moreover while making the convention that perpendiculars above and below the line of reference shall have opposite signs, and so also intercepts which lie to the right and left of the point of reference, he is not particular which is $+$ and which $-$ in any given case.

But while his mechanism is not as thoroughly conventionalized as it has since become, the equation of a curve remains as he defines it, a relation connecting the coördinates of each and every point of the curve. The only change is that the equations which with him are geometric, are now numerical. Descartes’ convention regarding the signs of coördinates is of great significance in the history of algebra. It gave the negative a recognition in that science which it had previously struggled in vain to secure.

But neither this nor the use of coördinates occurs first in the *Géométrie*. Girard in his *Invention Nouvelle en l’Algebre*, 1629,

and, for that matter, the Indian algebraists, represented negatives by lines drawn in the direction opposite to that assumed as positive; and Apollonius makes systematic use of coördinates. Nor did the representation of curves by equations originate with Descartes. Whether Apollonius surreptitiously made this use of the equation or not, the Arabian algebraist Alchay-yâmî (11th century) solved cubic equations by the intersections of conics, the cubic $x^3 = p^2(r-x)$, for instance, by the intersection of the parabola $x^2 = py$ and the circle $y^2 = x(r-x)$.

But Descartes was the first to appreciate the full significance of the "analytic" method, the first to develop it systematically in its complete form and to establish it as the principal method of investigation in geometry.

Having paused to classify curves according to the degrees of their equations, Descartes illustrates the power of his method by an investigation of the locus of a point from which lines are supposed drawn, each to meet and make a constant angle with one of a set of fixed lines, of such lengths also that the product of any particular set of them is in fixed ratio to the product of the remaining set: a problem which greatly exercised the Greek geometers and which according to Pappus neither Euclid nor Apollonius was able to solve except in particular cases. Also in a study of the ovals which bear his name and which he came upon in optics.

To two general problems he then gives especial attention: the problem of tangents and the problem of intersections of curves. The tangent he defines as cutting the curve in two coincident points and makes in the process of constructing this line *the first use of the method of undetermined coefficients*. He is enthusiastic over

his success with this problem. "Et j'ose dire que c'est ceci le problème le plus utile et le plus général, non seulement que je sache, mais même que j'aie jamais désiré de savoir en géométrie."

As to the intersections of curves, one can obtain them, he says, if only one can solve an equation of any degree in a single unknown quantity. This leads him into a digression on the theory of equations which occupies most of the third and last book of the *Géométrie*. This is astonishingly complete, and the best of it is new. It contains all the elementary transformations whereby the signs of the roots of an equation are changed, the roots all increased or multiplied by any quantity, the second term removed from the equation, etc.; his famous rule connecting the signs of the roots and the signs of the terms; the so-called Newton's method of divisors for reckoning out the commensurable roots; and a method for solving the biquadratic equation. He uniformly solves equations *by geometric constructions*, and is so impressed with the power of his method as to make the boast that by it equations of any degree may be solved; rather insinuating that he himself pauses at the biquadratic only because he wishes to leave the reader the pleasure of discovering the solutions of the higher equations.

Altogether the wealth of matter and method of this little treatise—for in Cousin's edition of Descartes' works it covers little more than 100 pages—is wonderful.

It is sometimes said to be hard reading, but not fairly, if the difficulty is attributed to obscurities of style or faults of arrangement. The style is concise but elegant, and Descartes' fine enthusiasm lends his methods a charm which one used to the beautiful and powerful new geometry is not accustomed to associate with them.

NOTE ON A FORMULA RELATING TO
THE ZERO-VALUE OF A θ -FUNCTION.

By HENRY DALLAS THOMPSON.

In Crelle's *Journal für Mathematik*, Vol. 100, page 87, Prof. Cayley considers a formula given by Herr Thomae in Crelle, Vol. 71, page 216, (11.), and comes to the conclusion that this formula contains an error; but the formula is probably correct. The difficulty is that Prof. Cayley uses the Jacobi notation, whereas Herr Thomae has used that introduced by Riemann.

The formula in question as given by Herr Thomae is:

$$(11.) \mathcal{H}((0)) = \sqrt{\frac{|\Lambda_\lambda(\lambda^1)|}{(2\pi i)^p}} \sqrt[4]{\text{Diser.}_0 \cdot \text{D'iser.}_0}$$

The Λ in this formula is defined on page 205, Vol. 71, as the whole period; the Λ which Prof. Cayley uses is the half-period, i. e.,

$$A = \int_{k_1}^{k_2} \frac{dx}{\sqrt{x-k_1 \cdot x-k_2 \cdot x-k_3 \cdot x-k_4 \cdot}}$$

The change which Prof. Cayley makes in formula (11.) corresponds to this change in the definition of Λ , and, therefore, he verifies the formula as given.

THE DIOPTRICAL PRINCIPLES OF THE
MICROSCOPE.

By GEORGE MACLOSKIE.

Preliminary Abstract.

For calculating the path of light through a centered system of lenses (omitting spherical and chromatic aberrations) the formulæ hitherto used are unnecessarily complex. I have tried an easy formula given in *Matthiessen's Dioptrik*, and find that it can be extended to all cases, so that a single formula, easily obtained and easily remembered, can be used to determine the focal lengths of lenses, doublets, objectives, and of the entire optical system of a mi-

croscope or telescope, and a slight variation of it enables us to find the principal planes of lenses real and imaginary. Thus we can understand the instrument without using the troublesome algorithm of continued fractions given by Gauss.

The method may be best illustrated by indicating its application to the problem of an objective given in *Nägeli and Schwendener's* book on *The Microscope*. It is required to find the focal lengths of an imaginary lens equivalent to an objective consisting of three doublets, each doublet being a plano-concave flint-glass lens backed by an equiconvex crown-glass lens, the refractive indices of flint, crown-glass and air being given.

I. For the surface refractions. The refraction of a ray through a surface from medium with index n_0 to another with index n_1 , produces two focal lengths, a first focal length, f_1 , for rays entering medium n_0 , and a second, ϕ_1 , for rays entering medium n_1 ; and the general equation is

$$f_1 = \frac{n_0 r}{\frac{n_1}{n_0} - 1}; \quad \phi_1 = \frac{n_1 r}{\frac{n_1}{n_0} - 1}$$

whereby, making r positive for rays approaching a convex surface, and negative otherwise, we can find the surface refractions. For the flat face of the flint lens we give the two values $f = -\infty$, $\phi = n \times \infty$, as the ratio of the two values is required.

II. For the Lenses. Having got the surface refractions (f_1, ϕ_1 for the first surface refraction, and f_2, ϕ_2 for the second) we apply our general formula to find the character of the lens as a whole. The formula is $f = \frac{f_1 f_2}{f_2 - \phi_1 + t}$ where f is the required principal focal length of the lens, t is the thickness of the lens, and the other terms are as already explained. The second focal length of the lens, ϕ , is equal to f with the sign changed, when the same me-

dium is on both sides, but may be got separately by the formula

$$\phi = \frac{-\phi_1\phi_2}{f_2 - \phi_1 + t}.$$

These focal lengths are to be measured from the principal planes, f from the first plane, ϕ from the second plane of the real or imaginary lens. I propose to designate the three segments depending on the principal planes, by the names *anteplane*, *interplane*, *postplane*, and the interval between the second principal plane of one lens and the first principal plane of the following lens (real or imaginary) by the term *transit* (indicating it in the formula by t as in combining two lenses it has the same function as *thickness* t , has in one).

The formulæ for determining the anteplanes and postplanes, and thereby determining the principal planes are

$$a_1 \text{ (anteplane)} = \frac{-f_1 t}{f_2 - \phi_1 + t};$$

$$a_2 \text{ (postplane)} = \frac{-\phi_2 t}{f_2 - \phi_1 + t}$$

(where t is either thickness or *transit* in different cases. It may be marked as t^e , thickness of crown-glass lens, t^l transit of doublet, t^o transit of objective.)

It will be observed that all the formulæ have the same form of denominator.

III. *For the Doublets.* The imaginary lens that is equivalent to a doublet has the first principal plane of the first lens as its face, and the second principal plane of the second lens as its back, whilst its

thickness is represented by the transit-distance between the second principal plane of the first, and the first plane of the second lens. Otherwise we employ the same formulæ as before for combining the focal lengths of the component lenses so as to get the focal lengths and principal planes and position of the equivalent lens.

IV. Having determined the Doublets, we use the same formulæ for *combining them into the Objective*. I have thus followed *Nägeli and Schwendener's* method by combining the second and third doublet to get a low-power objective, and by combining this with the front doublet, to get a high-power objective. The results reached are the same as by their method (saving a trifling arithmetical error in one of their calculations); but these results are reached in a much simpler and more intelligible way than the one which they follow. By combining the lenses of the eyepiece together, and finally eyepiece and objective, every step only a repetition of previous steps, we come to find the dimensions and focal length of an imaginary lens equal to the microscope or telescope. For both instruments alike, the ultimate principal planes are found to be external to the instrument, one in the air in front of the object-glass and the other somewhere in the eyeball of the observer; they can do him no injury, however, as they are merely imaginary planes devised to facilitate our calculations.

PRINCETON, Jan. 5, 1891.

REVIEWS OF BOOKS.

JAMES McCOSH. *The Prevailing Types of Philosophy, Can they logically reach Reality?* Pp. V. and 66. New York. Charles Scribner's Sons. 1890.

As the title of this little volume indicates it is largely historical and critical. The author finds three prevailing types in

modern philosophy, the Experimental and Sensational, the A-Priori or Kantian and the Scottish. These types are examined with reference to their attitude toward Reality. Dr. McCosh states his own view in the first chapter, "What is Reality?" We should assume reality as known. All

our powers give knowledge. The senses and self-consciousness reveal self and the external world. The truth thus obtained is elaborated by the discursive powers. We have also an intuitive knowledge of the First Principles of Truth and Duty. Upon these we build our metaphysics and morality. But Philosophy can reach a positive result only by starting with positive data, a knowledge of reality. The author then asks, "What do the leading philosophic systems of the day make of reality? Do they acknowledge it or do they deny it? Do they accept it in whole or only in part? Do they attempt to prove it or simply assume it?"

The remainder of the volume is devoted to the consideration of these questions and a chapter is given to each of the prevailing schools.

At the close Dr. McCosh sums up his conclusions in the following passage (pp. 44-45.) "Experiential Philosophy cannot give us universal or necessary truth, or any truth beyond the narrow limits of observation. It is doubtful whether it can furnish a valid argument for the existence of God. In the system of Locke we are supposed to perceive only ideas and are precluded from the knowledge of things.

Sensationalism gives us sensations and feelings variously compounded, and we cannot from these derive mind or even body as substances, but only, as Mill concludes, 'possibilities of sensations' and 'a series of feelings aware of itself.'

The A-Priori School of Kant makes our first perceptions to be of phenomena (appearances) and not of things. These are bound together by means of subjective Forms and Categories. The result is that when we would argue the existence of substance, cause, and other connections and of God, we find ourselves in a world of Illusions. A vigorous attempt is made to save us from nescience by calling in

Moral Reason which gives us a high idea of duty, of a judgment day and of God, which are all real; but it is doubtful whether the system can legitimately give us a known world of things to which to apply them. It is evident that an ideal world can give us only an ideal or pantheistic God.

The Scottish School proposes to be, means to be, and professes to be realist; but in the pages of Reid and Stewart it speaks doubtfully about our perceiving things, and in the pages of Hamilton it gives us only relative knowledge, which is not a knowledge of things as they are and ends avowedly in nescience."

The logical outcome of the unsatisfactory treatment of Reality by the prevailing philosophers, Dr. McCosh argues in the last chapter, is the Agnosticism of Huxley and Spencer. We must assert with Aristotle that the senses give us a 'certain kind of reality' and that all our powers lead us to truth rather than illusion in order that a solid foundation may be laid for philosophical and religious truth.

The book has an Appendix in which Aristotle's theory of Cognitions and Recent Criticisms of Kant are discussed.

A. T. ORMOND.

Livy: Books I, XXI, and XXII, with Introduction and Notes. By John Howell Westcott, Ph.D. Boston. Allyn & Bacon. 1891. Pp. XXVII and 399.

By common consent the three books of Livy here edited have come to be the portion regularly selected for American college class-rooms. This is no result of hap-hazard or caprice, but is due to the fact that the test of actual teaching shows that beginners are better interested and more profited by the tale of early Rome in the first book and of the great struggle with Hannibal, which begins with the other two books, than by any other equal portions of

the Histories. So it is fair to say that the best of Livy lies in these books, so far as concerns the interesting and benefitting of beginners.

In spite of this the American freshman has too often approached his Livy as if to disentangle some chain-puzzle of senseless word-sequences. This was not the fault of Livy but ordinarily of his imperfect schooling. But, whatever the cause, his Livy was apt to be a dreary memory to many such an ill-fitted student. This edition has this plight of the beginner in full view. Professor Westcott's book is aimed directly at the student and his needs. The assumption underlying his edition is that the beginner is ignorant of Livy, and is to be made acquainted with him. Hence the notes and helps are not made with any view to display of learning or elucidation of such trifles as Livy's "Patavinity," but to convey clearly and surely all the necessary facts. The edition is built piece by piece out of the editor's experience in the class-room, and a book so constructed, is more apt than any other to remove by anticipation those perennial self-repeating errors, which are common to every set of beginners.

Fortunately the text of Livy is so far settled that a new recension is not necessary. The one chief point of interest is the orthography, and here we think Professor Westcott has followed the only safe course, that is to allow variant spellings of the same word to stand, rather than to reduce everything to a uniform orthography, which, as he remarks in the Preface, "represents a state of things which never existed in ancient times."

Another and weightier matter is the insistence throughout the notes on pure English renderings of Latin idioms, instead of awkward and disjointed transportation of Latin into English. How hard it is to secure good English from a student who has no notion of Latin beyond a few em-

bryonic lines of grammatical structure, none but a teacher can know. The emphasis set on this point by Professor Westcott is strong and unmistakable.

Of the notes we cite such as those on the calendar (*duodecim menses*, p. 243), on Hannibal's route over the Alps (*non recta regione*, p. 322), and on the alleged "inherently improbable" story of the use of vinegar to soften the rocks (*infuso aceto*, p. 329), as examples of simplicity and completeness of statement. The Introduction is written in the same manner.

It is by such a text-book as this that a beginner may be made acquainted with Livy, if he is disposed to study at all. And Livy is well worth such acquaintance. A noble example of Roman patriotic feeling and of the historical cast of the Roman mind, he is also inspiring by reason of the poetic glamour which illuminates the plentiful flow of his style. This is what men of genius and feeling have found in him. Quintilian first caught the spirit in his phrase *illa Livii lactea Ubertas* (X. 1.32.) St. Jerome echoes it in his *Titum Livium lacteo eloquentiæ fonte manantem* (Preface to Vulgate), and the memory of it lingers in the very last book of Latin literature in the *Livii lactea eloquentia* of Richard de Bury (Philobiblon, cap. XV). Livy is eloquent, and is worth reading for this alone. If Freshmen get to see this, they have not toiled in vain.

ANDREW F. WEST.

EUSEBIUS. *The Life of Constantine together with the Oration of Constantine to the Assembly of the Saints, and the Oration of Eusebius in praise of Constantine.*

A revised translation, with prolegomena and notes, by Ernest Cushing Richardson, Ph.D., Librarian and Associate professor in Hartford Theological Seminary.

The first volume in the second series of Drs. Schaff and Mace's Early Christian

Fathers contains the translations of the writings of Eusebius. More than the first half is occupied by Dr. McGiffert's version of the Ecclesiastical History. The latter part is the work of Dr. E. C. Richardson, lately appointed librarian of the College. It consists of general and special prolegomena and of a translation, with short notes, of Eusebius' "Life of Constantine," Constantine's "Oration to the Saints," and Eusebius' "Oration in praise of Constantine." The translation is stated to be that of Bagster carefully but soberly revised. The editor's work consists mainly, therefore, in the prolegomena, with the main object of presenting as complete a picture as is possible of the personality of Constantine. Under the general heading: Constantine the Great, we find special chapters on his life, character, and writings, on the mythical Constantine and on the sources and literature of the subject. The last chapter is the most satisfactory, and is undoubtedly the most complete biography of Constantine. It shows wide reading and indefatigable research, as well as the quality lacking to many writers but necessary to a good librarian, of an unerring scent for books. The categorical arrangement so characteristic of these prolegomena is perhaps a consequence. A glance down the pages will show how careful the writer is that the gist of his meaning should not be missed. "As he was patient, so he was distinguished for *Perseverance* and firm and unshaken" (Theoph. p. 29) *Steadfastness*. The lavish use of capital letters and italics is rather unusual; so are the numerous references, all made in the text itself, which, while interrupting the sentence point inexorably to the source of every statement. Numerous references to contemporary politics, boodledom and secessionism are doubtless given in order to help break down the barrier of awe and estrangement with which the average reader

is supposed to look upon ancient history. In the psychological study of Constantine, which is attempted in such minute detail, all the charges against him, as well as the laudations of him are investigated and the result, to the author's mind, is favorable to the Emperor's admirers.

A. L. FROTHINGHAM, JR.

Are Acquired Variations Inherited? An argument opening a discussion upon the Lamarckian principle in Evolution. The Society of Naturalists, Boston, December 31st, 1890. Published in the AMERICAN NATURALIST, February, 1891.

This argument is designed to state as fully as possible the bearing of our present knowledge of the laws of Natural Variation upon the question of the inheritance of acquired characters as raised by Weismann. The opinions of Darwin and Huxley in 1871 are compared with those recently expressed to show that according to Weismann's school we have made actually no progress in the past twenty years. The argument is summed up as follows:

"The conclusion we reach in this discussion must finally turn upon the existence of definite lines of blastogenic variation. If there are no such lines, the Lamarckian principle falls *ipso-facto*—if there are, we have still to estimate the probabilities between Weismann's and Lamarck's principles as affording the most adequate explanation for them, keeping in mind the problem of Inheritance as affecting these probabilities.

The Weismann principle depends upon Selection as the source of definite lines of Variation. What evidence has been advanced for the initial but all essential assumption, that, for example, a tiny adaptive cusp is a factor in survival, while its tiny inadaptive fellow is a factor in extinction? Not to mention the succeeding assumptions which overwhelm us when we seek to derive definite adaptations from indefinite variations.

The Lamarckian principle furnishes us with an explanation of the observed phenomena of simultaneous progressive adaptation in most of those

parts which it affects, including Correlation and Parallelism. It cannot be said at present to explain *all* the phenomena within its sphere; we must explain these phenomena, or abandon the principle.

It follows as an unprejudiced conclusion from our present evidence that upon Weismann's principle we can explain Inheritance but not Evolution, while with Lamarck's principle and Darwin's Selection principle we can explain Evolution, but not, at present, Inheritance. Disprove Lamarck's principle and we must assume that there is some third factor in Evolution of which we are now ignorant."

The discussion was continued by Professor W. H. Brewer of Yale University, by Professor W. G. Farlow of the Botanical department of Harvard University and by Professor W. K. Brooks of the Johns Hopkins University, and then thrown open to the Society. The four papers will shortly be published together in book form.

Evolution and Heredity. Biological Lectures, Marine Biological Laboratory, 1890. Ginn & Co.

This is one of a course of Summer Lectures delivered at Wood's Holl, Mass., before the students and investigators working in the National and Collegiate laboratories. These lectures were designed to present the latest questions and results of research in different branches of biology. They are now collected and published in book form under the editorship of Dr. C. O. Whitman, Director of the Collegiate Laboratory.

This lecture presents the question of natural causation in evolution as affected by the views of Weismann upon Heredity, and shows that while Weismann has greatly simplified our conceptions of natural inheritance he has rendered the theoretical difficulties in the problem of evolution in a corresponding degree more complex.

SUMMARIES OF PAPERS.

THE SHORTENING OF THE COLLEGE COURSE.

By FRANCIS L. PATTON.

With the main points of contention in President Gilman's admirable paper I am in entire accord: That is to say, boys should leave the preparatory school a year earlier than they now do, and they should graduate as Bachelors of Arts a year younger than they ordinarily are. Then after three years in the prosecution of special or professional study, they would take their degree of Ph. D. or receive their diplomas in Law, Medicine and Theology.

I do not think, however, that this end could be so well attained by shortening the college course—and here again I am in accord with President Gilman. The work usually done in the Freshman year of our colleges can be better done in College than

the School. It must be remembered too that a large part of a college education, and in some respects the best part, grows out of the conditions of college residence and the influence that the students exert upon each other. To shorten the period of college life by taking a year out of the curriculum would be a serious loss to the undergraduates as well as to the college corporation.

I do not think that we shall accomplish much in the direction aimed at by emphasizing the distinction between the College and the University, for I do not think that it will be possible in this free land full of ambitious institutions of learning to secure a *consensus* of opinion among educated men that would settle the meaning of these two words. Institutions that call themselves colleges are many of them already doing in advance work that is sup-

posed to belong to the University, and those that are not doing it, hope to do it, and would be slow to part with the hope that by and by they will be able to do it. On the other hand, institutions that call themselves Universities are, with perhaps a single exception or two, all conducting undergraduate courses of instruction, and would be slow to give up the great body of candidates for Bachelor's degrees from whom they derive their chief support and through whom they make their strongest impression upon the intellectual life of the world.

It is well that there should be one or two institutions like Johns Hopkins University that will devote their energies in the main to the encouragement of advanced and highly specialized investigation; but a very few institutions of this kind will abundantly satisfy our intellectual demands.

Whether, then, the work be done in an institution that calls itself a College or a University, it is agreed that a certain kind and amount of liberal education should be acquired before the student enters upon professional study, or gives himself to the exclusive prosecution of a literary or scientific specialty. For the acquisition

of such an education a period of four years is not too long.

The only question then is as to the method to be followed during these four years. Shall the studies be all prescribed; shall they be all elective; or shall they be in part prescribed and in part elective? The plan that with various modifications is being generally adopted in our American Colleges and Universities whereby during the Freshman and Sophomore years the studies are in the main prescribed, and where in the Junior and Senior years an increasing range of choice in the selection of studies is open to the student, seems to me to be the best solution of a problem that is beset undoubtedly with great difficulties. It is a plan that combines in some measure, and it seems to me very successfully, the disciplinary system of the Gymnasium and the freedom of the University—using the word in the meaning imposed upon it in Germany. It is the natural and logical development of our educational system, and is commendable, however unique, because it is the out-growth of our historical conditions.

[Address made before the meeting of the College Association of the Middle States and Maryland, Nov. 29, 1890.]

NOTES.

Art and Archaeology.—Prof. Frothingham delivered the opening lecture in the department of Architecture at the Brooklyn Institute on October 15. The subject was "Romanesque Architecture in France and its transition to Gothic."

He also lectured on December 12 in Philadelphia before the Archæological Association of the University of Pennsylvania. The lecture was entitled "The Ancient Cities and Monasteries near Rome."

Prof. Frothingham lectured on January 21 at Columbia College. "Rome and the Early Renaissance of Art." It was the opening lecture in the series to be given by the New York Society of the Archæological Institute.

Prof. Hunt will take part, as in former years, in the Saturday Morning Lecture Course at Columbia College, lecturing, this year, on Robert Browning.

Prof. Hunt has in the past two years contributed to the *Homiletic Review* (N. Y.)

papers on Old English Ethical subjects; these will be followed this year by discussions of the following topics: 1. Cynewulf's Christian Verse; 2. The Ethical Element in Chaucer; 3. Richard Rolle of Hampole; 4. William Caxton, the First English Printer.

Prof. Young lectured at the Brooklyn Institute on December 31 on "The Spectroscope among the Stars"; the illustrations included some of the most recent photographic work on the stars.

In the last number of the *Proceedings of the Huguenot Society of Great Britain* Sir Austen Henry Layard gives a flattering notice of Professor Marquand's paper on Huguenot Industries in America (*Proceedings of the Huguenot Society of America*, Vol. I, No. 2).

During the Second Term, Prof. Osborn will deliver four University lectures upon "*The History of the Theory of Organic Evolution*":

- I. The Naturalists and natural philosophers of the 18th Century.
- II. Lamarck and his followers.
- III. Darwin and his influence.
- IV. Weismann and the present problem in Heredity.

In Geological Hall. Time will be announced later.

THE AMERICAN JOURNAL OF ARCHÆOLOGY.

As the contents of this review emanate so largely from Princeton, a notice of its numbers for the past year, 1890, may well be presented in this BULLETIN.

An excellent summary of the March and June double number was given in the London Academy for Oct. 4, and from it we quote the following:

"The last number of the *American Journal of Archaeology* consists of 260 pages of letterpress and xv plates.

"A notable feature is a series of three articles dealing with questions in the historical development of architecture, which all issue from Princeton College, New Jersey. The first of these, by Prof. A. L. Frothingham, junior, the managing editor of the *Journal*, aims at proving that the principles of transitional Gothic Architecture were introduced into Italy by the French Cistercian monks. The writer's conclusions are based upon three tours, during which some forty monuments in Central Italy were studied and photographed. In opposition to the common opinion; Prof. Frothingham maintains that the Cistercian, and not the Franciscan and Dominican, monasteries were the earliest examples of the Gothic style in Italy; and, as a corollary to this, that it was from France, not from Germany, that the most fruitful breath of Gothic influence came into Italy. [BULLETIN, vol. I, 1, 4; II, 3, 4.] The second of these Princeton articles is entitled "Reminiscences of Egypt in Doric Architecture," by Prof. Allan Marquand, one of the editorial contributors of the *Journal*. He thus summarises his conclusions:

"We have found reminiscences of Egypt in Doric temple-architecture in the temenos, with its sacred trees and springs and altar; we have found that the Greek preserves the Egyptian methods of construction, even to the use of slanting walls and stuccoed columns; that the diminution, entasis, echinus and annuli of the Doric shaft may be best explained upon the hypothesis of an Egyptian origin, and that the Ionic and Corinthian capitals become intelligible in the same way; etc. [BULLETIN, vol. II, No. 1.]

"The third of these papers is by Mr. George B. Hussey, who states that the subject was suggested to him, while fellow in archaeology at Princeton College, by Prof. Marquand. It is an attempt to enumerate the Greek temples of which we have evidence, and that to estimate (1) the importance of the cities, and (2) the relative degree of reverence in which the several deities were held. [BULLETIN, II, 2.]

"We may next mention two brief articles by foreign contributors. M. Eugène Müntz, of the Ecole des Beaux-Arts, Paris, sends a second paper describing the lost mosaics of Rome that are known to have been in existence between the fourth and ninth century. Herr Paul Wolters, of the German Archaeological Institute at Athens, argues that the marble relief found at Marseilles in 1888—which has generally been considered to represent Artemis—is really Zeus of Heliopolis; and he supports this identification by a comparison of it with the very similar relief found at Nîmes in 1752, which bears

an inscription dedicating it to Jupiter Heliopolitanus. The woodcuts given certainly seem to establish his point.

"Then follow a number of papers contributed by members of the American School of Classical Studies at Athens. Perhaps the most important of these is another collection of statistics by Mr. George B. Hussey, in which he has brought together all that is to be known about Greek sculptured crowns and crown-inscriptions. [BULLETIN, II, 3.] Mr. John C. Rolfe reports upon the excavations carried out in the spring of 1889 at Anthedon, Plataea, and Thisbe, acknowledging his obligations to Mr. R. W. Schultz, of the British School, for his plans of Anthedon. Apart from inscriptions, the most interesting discovery was a large collection of bronze implements at Anthedon, which probably represent the stock of a bronze-smith. These are excellently figured from a photograph of Mr. W. J. Stillman.

Finally, we have the usual valuable collection of reviews and archæological notes, which alone fills more than half the number. Prefixed to this is a letter from Egypt, by Mr. Farley B. Goddard, the American scholar of the Egypt Exploration Fund. Though it is dated in March last, we believe that his strictures upon the condition of the Gizeh Museum still holds good."

The *September* number (176 pages and vi plates) contains the first of a series of important papers on a Christian palace lately discovered under the church of S. S. Giovanni e Paolo in the Coelian in Rome. It was the residence of the two saints John and Paul, high officers at the Court of Constantine and his successors and martyred under Julian. The discovery and subsequent excavations are due to the writer of these papers, Padre Germano, who is also the head of the Passionist monastery attach-

ed to the church. The first article confines itself to a description of the monuments of the Coelian that surrounded the house and to the architecture of the house itself. The excavations are being carried on, partly through funds secured by Professor Frothingham. Dr. William Hayes Ward, editor of the *Independent*, contributes another of his series on Oriental antiquities and treats of two subjects. The first is a unique Babylonian cylindrical bas-relief found in a mound near Urumia in Persia, in a chamber with a corbelled vault constructed on archaic principles of architecture. The cylinder is of translucent alabaster and unique in its size, measuring nearly ten centimetres long: the figures carved upon it in relief represent the Sun-god coming out of the gates of the morning. The second paper treats of the dragon Tiamat, the representative of chaos in the creation, and other evil spirits as figured on Oriental Seals.

Professor Frothingham contributes the second paper in his series on the introduction of Gothic architecture into Italy; the monument selected for illustration is the monastery of San Martino near Viterbo [BULLETIN, vol. II, 4]. He also continues his notes on the Roman artists of the Middle Ages by publishing the names and works of three architects of the twelfth and thirteenth centuries. Mr. Paton, the well-known English classic scholar, contributes some comments on Prof. Tarbell's "Study of the Attic Phratry" which appeared in the *Journal* for June 1889: and this is followed by Prof. Tarbell's answer.

Then follows a very full summary of recent discoveries and investigations, covering over eighty pages, collected by Professor Frothingham; and a summary of the contents of some fourteen archæological reviews.

CHARLES SCRIBNER'S SONS' NEW BOOKS.

HISTORY OF THE UNITED STATES.—By HENRY ADAMS.

The complete set, nine volumes in a box, \$18.00.

First Administration of Thomas Jefferson, 1801-1805, 2 vols., \$4.00. Second Administration of Thomas Jefferson, 1805-1809, 2 vols., \$4.00. First Administration of James Madison, 1809-1813, 2 vols., \$4.00. Second Administration of James Madison, 1813-1817, 3 vols., \$6.00.

"No more spirited, graphic or picturesque study could be desired. Its style is animated, clear and impressive. Its portraits are vivid and well colored. Its descriptions are masterly. Altogether this history deserves to rank with the best of the time."—*N. Y. Tribune*.

INTRODUCTION TO THE STUDY OF INTERNATIONAL LAW.

By the late THEODORE D. WOOLSEY, D.D., LL.D.
New and revised edition. 8vo, \$2.50.

In this, the sixth edition of this standard work, the author's son, T. S. Woolsey, Professor of International Law in Yale University, has brought the discussion of the subject up to the present time in a form a little more popular than before.

OUTLINES OF PHYSIOLOGICAL PSYCHOLOGY.

By GEORGE T. LADD, D.D. Illustrated. Cr. 8vo, \$2.00.

"This is not a mere abridgment of the author's larger book but an independent work, and traverses the whole field in a vigorous, terse, clear style that admirably fits it for its intended use. It is suited to be a text-book for academies and colleges."—*N. Y. Examiner*.

A SHORT HISTORY OF ANGLO-SAXON FREEDOM.

The Polity of the English-speaking Race Outlined in its Inception, Development, Diffusion and Present Condition. By Prof. J. K. HOSMER of Washington University, St. Louis. Crown 8vo, \$2.00.

It has been his purpose to show the unity of tendency that runs through the whole history of Anglo-Saxon political development. It is of great interest, and no reader can fail to have his ideas broadened by reading its discussion in Professor Hosmer's thoughtful and scholarly book."—*N. Y. Tribune*.

PRINCIPLES OF POLITICAL ECONOMY.

By ARTHUR LATHAM PERRY, LL.D. Cr. 8vo, \$2.00.

"It is the outgrowth of his earlier works, embodies his well known views and sets them forth with ripeness and more effective skill than ever. It will do good service as a text-book."—*Congregationalist*.

EMIGRATION AND IMMIGRATION.

A Study in Social Science. By Prof. RICHMOND M. SMITH of Columbia College. 12mo, \$1.50.

"A volume on a topic that is of vital importance at the present time. It is a work that in comprehensiveness, conciseness, and usefulness would be difficult to surpass."—*Boston Saturday Evening Gazette*.

TALKS WITH ATHENIAN YOUTHS.

Five Selected Dialogues translated from Plato. 12mo, cloth, \$1.00; paper, 50 cents.

These dialogues vividly portray the flower of Athenian youth that listened to Socrates's teaching, and have, therefore, not only the philosophic value of the writings of Plato in general, but also the human and social interest that attaches to the mental habits and characteristic figures of the Greek race at the culmination of its civilization.

PREVIOUS VOLUMES.—Socrates—Talks with Socrates about Life—A Day in Athens with Socrates. Each 12mo, cloth, \$1; paper, 50 cents.

"Eminent scholars attest the skill and truth with which the versions are made. We can confidently speak of their grace and clearness. They seem a 'model of style,' because they are without manner and perfectly simple."—W. D. HOWELLS.

LIFE OF JOHN ERICSSON.

By Col. WILLIAM C. CHURCH. With 50 Illustrations. 2 vols., 8vo, \$6.00.

"Two noble volumes. The task has been very well performed. The book will remain a monument to Ericsson's genius, and of the transcendent importance of the service which he rendered."—*Chicago Advance*.

ELECTRICITY IN DAILY LIFE.

A Popular Account of the Application of Electricity to Every-day Uses. With 120 Illustrations. 8vo, \$3.00.

"It consists of ten chapters, each written by one of the masters in electricity. It is a valuable book on a subject of ever-widening interest."—*The Evangelist*.

IN SCRIPTURE LANDS: New Views of Sacred Places.

By EDWARD L. WILSON. With 150 Illustrations from Photographs by the author. Large 8vo, \$3.50.

"Here we have a man with the courageous spirit of an explorer, a good pair of eyes, a good camera, and a good literary style. We have seen no work of exploration and travel in those lands which gives so clear an idea of them, and of the historic remains and scenes, as this."—*Chicago Interior*.

* * * The above books for sale by all booksellers, or sent, post paid, on receipt of price, by

CHARLES SCRIBNER'S SONS, Publishers, 743-745 Broadway, New York City.



HON. CALEB S. GREEN, LL.D.

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. III.

APRIL, 1891.

No. 2.

A BUDGET OF OLD LETTERS.

The following letters explain themselves in most points so fully that only a few brief notes need be added to them. They have been copied from *MSS.* in the possession of the New Jersey Historical Society, and are published here only as adding interesting particulars to what is already familiarly known with regard to the early history of the college.

Upon the election of Rev. Aaron Burr to the presidency of the college in 1747, it was removed from Elizabethtown, where it had been established the year before, to Newark, where it was to find a temporary home till 1756. It was easily moved, for it had no material equipment whatever: it could be carried whithersoever its president and tutors could induce their pupils to accompany them; and it was rightly felt by its friends and supporters that it could never have any stable fortunes until it did obtain somewhere permanent buildings and apparatus. The public spirited governor of the colony, Jonathan Belcher, from whom the college received its second charter, in 1748, was actively enlisted in all efforts to give it permanency and strength, and was among the most urgent of those who advised final settlement and a building. "If money cannot be raised for the House and to support the necessary officers," he said, "the thing must be given up." A site also was necessary, to put "the House" upon, and New Brunswick

and Princeton, both of which were deemed suitably near the centre of the Province, were asked in turn whether they would, within a fixed time, give to the college ten acres of cleared land, two hundred acres of woodland, and a thousand pounds of money. Princeton made the gift and was fixed upon as the home of the college. A good deal of money was raised among the friends of the institution in the colonies, but not enough to justify building. The trustees therefore requested the Rev. Gilbert Tennent and the Rev. Samuel Davies to make a tour of Great Britain and Ireland soliciting money to carry out the plan of building at Princeton. It is of the result of that tour that the following letter speaks:

DEAR AND WORTHY SIR:—

Your most obliging Favour of Augt. 28th. came safe to hand a few days ago, which I read with much Gratitude & Pleasure. It brought us very agreeable News about the Scotland Collection, which has exceeded our Expectations at least 300 pounds, as my good Friend Mr. Erskine wrote me some time ago, that he did not think it would amount to more than £700. We are sensible how much we are indebted to you, & your worthy Son for our Success in this Affair, May the Giver of every good & perfect gift reward you a thousand fold with temporal & spiritual Blessings in Christ Jesus. Liberty for drawing Bills comes very seasonably, as the Exchange is just now higher than it

has been any time since ye last War. Our Bills will not reach Mr. Belchiers, till some time in January, as none will be of earlier date than this Letter; so there appears no danger of this coming too soon.

Enclosed you have a Copy of Mr. Belchier's Acct. As also Messrs. Tennent & Davies with the Trustees; that you may see how divine Providence has smiled upon o'. Undertaking, & I hope you will help us, by your prayers to give God the Glory. We have hear'd Nothing from Scotland yet.

We have begun a Building at Princeton which contains a Hall, Library & Rooms to accomodate about an 100 Students, tho' it will not any more of it be finished than is absolutely necessary at present, with a house for the President. We do everything in the plainest & cheapest manner, as far as is consistent with Decency & Convenience, having no superfluous Ornaments. There was a Necessity of our having an house sufficient to contain ye Studts. as they could not lodge in private Houses in that Village, where we have fix'd the College, which, as it is the Centre of the Province, where Provisions are plenty & firewood will always be cheap; is doubtless the fittest place we cou'd have pitched upon. The Buildings prove more expensive than we at first imagined, from the best computations we could get; but by the smiles of heaven upon us we shall be able, I think to compleat what we design at present; & have at least a fund left of 1600 Ster: which with the other income of the College will be sufficient for the present Officers & a little more: as Money here will rent out [?] for 7% Cent Interest with undoubted Security.

This Fund will be encreased by what we get from Ireland, and little more we expect from South Britain. And we hope by the help of some generous Benefactors here & abroad to be able before long to support a Professor of Divinity, that Office

at present lies on the President, with a considerable part of the Instruction in other branches of Literature. The Trustees have their eyes upon Mr. Edwards And want nothing but Ability to give him an immediate Call to that Office.

The Students in general behave well; some among y^{em} that give good evidences of real Piety, & a prospect of special usefulness in the Churches of Christ, are a great Comfort & Support to me under the burden of my important Station. I may in my next give you a more particular Acct. of the Collge. it is at present under flourishing Circumstances in many Respects has grown in favour with the Men, I would humbly hope God also. 'Tis my daily Concern that it may answer the important Ends of its Institution & that the Expectations of our pious friends, at home & abroad, may not be disappointed.

I shall not fail to acknowledge My Lord Lothian's generosity. I am sorry Messrs. Tennent & Davies neglected seasonably to acquaint their Friends in Scotland of their safe Arrival &c.: I hope their long & tedious passages & the Confusion their Affairs were probably in, by their Absence, may be something of an Excuse. I can testify that they retain a very lively sense of the most generous Treatment y^t they & the College met with in those Parts.

The Defeat of Generl. Braddock was an awful, but a seasonable Rebuke of Heaven. Those that had the least Degree of Seriousness left, could not but observe with Concern, the strange Confidence of an Arm of Flesh, & Disregard to God & Religion that appeared in that Army. Preparations were made for rejoicing at the victory, as Tho' it had been ensured & a day appointed for the obtaining it. The whole Country were alarm'd & struck with Astonishment at the News of his defeat, & some awaken'd to eye the hand of God in it, who had tho't little of it before. And I can't but think God has brought good to

the Land out of this Evil. On the Contrary, God was acknowledged in the Army that went for Crown Point; Vice & Debauchery suppress'd in a manner that has scarce been seen in this Land, & was much admired by those that saw it: This was much owing to Major-Gener'l Lyman, with whom I am well acquainted; he is a Man of Piety; & for Courage & Conduct, aspect of Government & good sense he has not his superiour in these parts. He acquitted himself with uncommon bravery & good Conduct in the Engagement at Lake George Sept. 8th, And it was much owing to him, under God, y^t the Victory was obtain'd, which prov'd a means of saving ye. Country from ruin, as has since more fully appear'd by the scheme y^e french General had laid. I gave this hint about Mr. Lyman, because Mr. Edward Cole, one of y^e Officers, being offended y^t he banished some Lewd Women from the Camp y^t he had brought with him, wrote a Letter to scandalize him, hinting that he was a Coward; tho' Numbers that were in the Engagement have fully established his character, as one of the bravest Officers, who expos'd himself in the hottest fire of the Enemy, animating his Men. And Gen'l Johnson himself acknowledges y^e honor of the day was due to Mr. Lyman.

The State of these American Colonies, at present, looks dark. We are divided in our Councils, some are of such a Spirit that they will forward nothing but what they are at the head of themselves. Several of the Governours in the Continent are now met at N. York to concert Measures for the safety of Country. Much will depend on the result of this meeting. When I consider y^e crying Iniquities of the day, I cannot but tremble for fear of God's Judgments that seem to hang over this sinning Land.

I have lately had a Letter from Stockbridge: Mr. Edwards & his family are in usual health, except his daughter Betty,

who is never well, & I believe not long for this world. Their Situation is yet distressing thro' fear of the Enemy. My Wife joins me in respectful & affectionate Salutations to you & your Son. I add but my poor prayers & ardent wishes, y^t your declining Days may be fill'd with Comfort & usefulness, y^t you may have a late & an abundant Entrance into y^e everlasting kingdom of our Lord & Saviour Jesus Christ. Amen.

With much unfeign'd Respect

I am, very Dr. Sir,

Your most oblig'd & Affectionate
Friend & hum^{ble} Serv^t:

[Rev.] Aaron Burr.

Newark, Dec^r. 3^d., 1755.]

Mr. Hogg.]

P. S. The orig^l of w^e this is a Copy comes via N. York. I send Duplicates as we expect daily to hear who is proclaimed. O^r good Governor, Mr. Belcher and Sundry of o^r Trustees have had the Pleasure of seeing your Letter & they all unite in their Salutations & grateful Acknowledgements to you. Mr. Ingrams kind Letter came to hand with yours acquainting us y^t he had collected L.320 Ster.

Yrs. &c.

A. B.

Mr. Wm. D. Smith, one of o^r Trustees is appointed to draw up a Letter of Thanks to y^e Gen^l Assembly in Name of Trustees, w^e I suppose will be sent to y^r Care.

Apparently "Messrs. Tennent and Davies" were somewhat remiss in writing to their friends in Scotland after their return, to acquaint them with the fact of their safe arrival at home and to make specific acknowledgment of favors received. Certain irresponsible persons even gave currency afterwards to a scandalous report to the effect that they had not been very exact or careful in rendering an account in detail of the sums they had received. It is evident from the reference in Presi-

dent Burr's letter, above, to the account of Messrs. Tennent and Davies, of which he encloses a copy, that the whole matter was really in perfectly unexceptionable shape; but doubtless it is to talk of some irregularity in these transactions that the opening passage of the following letter refers.

[Extract of letter to Revd. Aaron Burr, Pres. Col. of New Jersey.]

REV'D. SIR:

* * * * *

I have communicated your Letter relating to the College to several Ministers and Gentlemen in London, who are all perfectly well satisfied therewith, And I have also wrote to a very worthy Minister at Bristol, Mr. Hugh Evans, who was a hearty promoter of the Design of Mr. Tennants Mission, that if he hears any Reports to the Disadvantage of the College, he may be able to do Justice to the Institution by vindicating it from any such unjust Aspersions. But I am very much inclined to believe that these evil Reports have had no great Spread, for I dont remember to have heard amongst my Acquaintance any thing suggested in prejudice to the College, but on the other hand a General Satisfaction has been always exprest.

* * * * *

* * * * *

I beg leave to congratulate you upon your being settled so much to your Satisfaction at Prince Town, and rejoice to hear the Agreeable Account you give of the Students, and of the Present State of the College; I most heartily wish its growing prosperity, and that it may prove a constant source of increasing Comfort to yourself. And am Sir

Your most Obliged Friend and Obedient Sert.

London Octr. 14, 1757.

J. WARD.

* * * * *

The whole movement of the Revolution and the establishment of the Union separates this letter from the next, which is from the pen of the sixth president of the college, and concerns matters very familiar to all college authorities, a legislative grant of money and the publication of works of learning. Dr. Smith had been elected President in May, 1795.

PRINCETON, Feb. 13th, 1796.

DR. SIR:—

I have been here for a week past along with the Committee of the trustees waiting upon the legislature of the state for some public aid to the College. We have a considerable prospect of succeeding beyond our expectations when we came, tho' perhaps not equal to our wish.—A resolution has passed the grand committee of the lower house of one member from each county, to grant the College an annuity of £500 for —— years. This report is to be made & discussed in the house to day.

But the principal object of this letter is to request you to enquire among printers & booksellers in Phila. on what terms they would undertake a new edition of Dr. Witherspoon's published works, with the addition of what we can collect among his papers since his death, amounting perhaps to a volume, or volume & half octavo of from 500 to 600 pages—These posthumous papers will consist of his M. Philosophy—about eight, or ten sermons— Some dissertations— letters & speeches in Congress. We can find some other small books of written sermons— but no mortal can read them— And a copy of lectures in divinity but the greater part of these are written in short hand characters so as to be utterly useless— The five duodecimo volumes published in his life time will probably make three octavo— So that the whole will form about four or five Octavo volumes.

I wrote to Mr. Webster in New York to enquire on what terms he would under-

take the publication. He informed me that if he could procure a pretty good subscription to begin with he would put the work to press & give Mrs. Witherspoon every seventh copy in sheets. But this seems so small a profit that she has hardly thought it worth while to be at the trouble of collecting the manuscripts, & transcribing a considerable part of them which would be necessary for the printer & then to be at the additional trouble of binding & selling her share of the sheets. I thought it possible that some person in Phila. might give her a more eligible offer. If not it will be better to send to Britain.

I will thank you when you have informed yourself on the subject to be good enough to let me know the result.

I am,

Dr. Sir,

Yr. Mo. Obdt. Hble. servt.

[Superscription.] SAM'L. S. SMITH.

To the

REV. ASHBEL GREEN.

Philadelphia.

Dr. Maclean says, in his History of the College (Vol. II, p. 18), that the amount actually appropriated by the legislature was £600; that the grant was so unpopular among the people of the State that every member of the legislature who voted for it was defeated at the next election; and that it is the only pecuniary aid ever received by the college from the State Treasury. The grant was "limited to three things, viz., the repair of the college buildings, the restoration of the college library, and the repair and purchase of philosophical apparatus." This explains what follows.

PRINCETON, April 15th, 1796.

DR. SIR:—

I am happy to learn from your worthy father whom I saw yesterday, both your health & the success you have hitherto met with in your transactions with the

british. I pray God that you may be able to bring your whole negotiation to that favourable issue anticipated by your friends, & that the follies of our councils may not blast the fruits of all that you have already done.

The object of this letter, however, is to employ you a little for the interest of the College where you have had the elements of your education, & to which, I am sure, you still retain your friendship. You will not esteem it a trouble to render it any service in your power. I have to request you therefore to procure on the best terms possible, & to send by the first vessels that are coming to this country, an apparatus of instruments for exhibiting experiments in natural philosophy agreeably to the annexed list— I have already procured, by private contribution, a tolerable apparatus for chemical experiments; & have an excellent professor in that branch from Glasgow. So that when the instruments which you will be good enough to send shall arrive, the College will be pretty amply furnished with the means of instruction in natural science. By the exertion of a few of us at the last Session of the Legislature of this State, a small sum of money was obtained from them for the purpose of making this purchase; & the bills shall be remitted to you by the first vessels that will sail in May from Philadelphia or N. York. You may go with certainty as far as 1200 dollars, for which sum you will receive the bills in May, or early in June. But if it should be necessary to exceed this sum in order to procure the best instruments, or any new additional ones, besides those in the annexed list, which may be recommended to you by your philosophical friends in London, General Bloomfield begs me to assure you that he will punctually answer your draft, or make the remittance to you as you shall please, to the amount of five or six hundred dollars more— Gen. Joseph

Bloomfield lives in Burlington, & the draft, if you choose to draw, may be made on him or me. I wish for the best instruments of the respective kinds; but plainly mounted in order to save expence. If they are any of them second hand, I shall, for the same reason, have no objection to them, if they are equally good.

You will greatly oblige me, as well as the College, by your attention to this business, & by the expedition with which we can receive the instruments. My confidence in your friendship assures me that this is a commission which you will execute not only without esteeming it painful, but with particular pleasure. That friendship, formed so early in your life, will always be source of satisfaction to

Dr. Sir,

Yr. Mo. Obdt. Hble. Servt.

[Superscription.] SAM'L S. SMITH.

SAMUEL BAYARD, Esq.,

American Agent,

London.

Samuel Bayard was afterwards made Treasurer of the College. "The excellent professor in that branch from Glasgow," referred to in the letter, was John Maclean, M.D., father of the Rev. John Maclean who, in 1854, became President of the College.

The last letter of the budget calls for no comment.

PRINCETON, April 1st, 1799.

DEAR SIR:—

Mr. Boyd delivered me your letter on Saturday morning— but preparing to

preach on Sunday I could not attend to the epitaph for Dr. Witherspoon till to day— I am not in possession of materials to compose one for Dr. Finley. Perhaps from Mrs. Finley or from Dr. Rush who is both his relation & his pupil, the anecdotes of birth &c. & some of his character might be procured. If you will take the trouble to collect the materials, I will at any time, if you please give them a latin dress.— I neglected that for Dr. Witherspoon till this time, tho' I ought sooner to have attended to it. Being done so hastily, there are probably some expressions which, on a future review I might wish to alter. After I had finished it I went into the Church-yard to examine again the inscriptions on the tombs of the other Presidents which I have not read for many years before—but I found so many interjections that suited the period in which they lived, & the real pre-eminence of the men above their contemporaries, that I thought any close imitation of them would suit neither the subject nor the times in which we live. I determined to make no change in the plainness of what I had written, which is more adapted to the cool & simple character of the man. I added only the last sentence, *qualis quantusque* &c. which you may either retain or omit as you please.

I am Dr. Sir,

Yr. Mo. Obdt. hble. servt.

[Superscription.] SAM'L S. SMITH.

The Revd.

DR. ASHBEL GREEN,

Philadelphia.

HON. CALEB S. GREEN, LL.D.

The death of the Hon. Caleb S. Green, at Trenton, Feb. 19th, 1891, calls for more than a passing notice. Princeton College had among her Trustees no one wiser or more influential and among her benefactors none more devoted and responsive to the growing wants of the institution. His ca-

reer in life was marked by qualities of solid strength, inflexible integrity and determined energy. To the general public he was less known than his brothers, the late John C. Green, of New York, and Chancellor Green of New Jersey; in his own community and in college circles he

has been for years a prominent figure. He was born in Lawrence township, N. J., Feb. 18th, 1819. After a course of preparatory study at the Lawrenceville High School he entered Princeton College and was graduated in the class of 1837. He was for a short time engaged in mercantile pursuits, but soon left them for the study of the law in the office of his brother, Chancellor Henry W. Green. On the completion of his legal studies he was admitted to the bar in 1843, and entered on the practice of the law in Trenton, where he resided till his death. In 1873 he received an appointment as lay judge in the Court of Errors and Appeals. His ability in this position was "so marked that he was often called upon to write opinions in the cases before the Court." His reputation for clear and discriminating judgment, his acknowledged financial ability, his high integrity made him sought for various positions of honor and trust. In 1853, he was elected President of the Trenton Savings Fund Association, a position held till his death. In 1862, he was appointed one of the managers of the State Lunatic Asylum, succeeding to the presidency of the Board in 1889. His membership of the Board of Trustees of Princeton College dates from 1872, and of the Board of Trustees of Princeton Theological Seminary from 1876. Together with the late Judge Nixon and Charles E. Green, Esq., he was appointed an executor of his brother John C. Green's estate. The rapid growth, the extended usefulness of Princeton College, must always be dated first from the generous purposes of Mr. John C. Green and then from the comprehensive wisdom and liberal policy with which the executors administered their trust. Judge Green was by nature a conservative. He

had an aversion to all change and demanded strong reasons for it before his assent could be gained. But in the service of the College, as administrator of the trust above mentioned, and as a member of the Board of Trustees, he was prompt in advocating every wise advance along new educational lines. It may be said that during his last years his thoughts and interest were concentrated on two great subjects, education and religion. His liberality in promoting both was as marked as his intelligence in directing his gifts. No worthy appeal for either was unheeded by him. For years he had maintained during their college career a number of deserving students in need of pecuniary aid. The influence of his mother, he was fond of saying, led him to do this.

Judge Green was a man of the greatest simplicity in all his tastes. He had a horror of everything like ostentation. His nature was downright, absolutely sincere and in his detestation of indirection and stratagem his manner sometimes verged on brusqueness. But the innate kindness of his heart was easily seen under all the bluntness of his speech and far oftener a quaint old-time courtesy of deportment gave charm to his intercourse. He became a member of the First Presbyterian Church in Trenton late in life. Christianity he had long accepted as his faith. It was characteristic of him that he was deeply concerned to have the College kept firm and true on its ancient basis of Christian education. In more than one interview with the writer of this notice he expressed this as his deepest conviction and most earnest desire. Princeton College will long have occasion to honor the memory of Judge Green.

PROF. R. E. THOMPSON'S STONE LECTURES.

The lectures on the L. P. Stone foundation for 1891 were delivered in the Seminary Chapel by the Rev. R. E. Thomp-

son, D.D., Professor of History and English Literature in the University of Pennsylvania. They were eight in number, two

being given each week for four weeks. The subject was *Christian Sociology in the Light of the Bible*, and included four principal sub-themes: the Family, the Nation, the School, and the Church.

LECTURE I. was introductory and called attention to the present pressure of social problems, the large part they play in the thought of the times, and their practical importance. In our study of these problems we must go to the Bible as a sociological book, from which we get our earliest information about the human family as well as our highest hopes of its ultimate happiness. The social tendencies of the day are a reaction against mere individualism in religion, which received so much emphasis in the theocratic convictions of the early Reformed Church. The struggle for individual liberty is a thing of the past. This battle may be said to have been fought out to a complete victory. The lecture closed with a contrast between Christian and Agnostic sociology.

LECTURE II. discussed the Family as "the institute of the affections." It is the primitive institution, and in the earliest times monogamy was the rule. Polygamy came in with the corruption of the race, was incident to man's fallen nature, and from very early times has had more or less prevalence, limited by the naturally equal distribution of the sexes. Dr. Thompson in this lecture gave a full description of the Family as seen in Pagan, Jewish, Moslem and Christian forms of society. The Christian ideal is derived from the divine relations of the human race. The prevalence and exaltation of celibacy in the Church were noted and its evil effects, not only upon priests and monks themselves, but also upon the Family as an institution. The Reformers combated this evil, Luther himself pre-eminently.

LECTURE III. continued this subject, taking up materialistic theories of the

Family, the place and influence of heredity as the great transmitter of the blessings of civilization, the mutual duties of the various members of the Family, family discipline and education, and the Family in the Church. The lecturer insisted that woman's sphere, while as lofty as man's, is not identical with it. After speaking of divorce laws and orphan asylums (of which Professor Thompson is not fond), the lecture closed with some thoughts on the Tribe, or the Family trying to be a State.

LECTURE IV. advanced to the Nation, "the institute of rights," its historic origin in the existence of men in increasing numbers, its foundation in the Divine Will and in human nature, and its moral personality and responsibility. It is "a covenant with God." The ancient and modern forms of the State were described. The *lex talionis* is the true basis of punishment. Law has a divine sanction. The true government is a theocracy in the sense that God is behind every throne.

LECTURE V. unfolded more fully the subject of the preceding lecture and began with Mazzini's definition of a nation as "the will to be one." This will makes a nation of several tribes or several separate social communities. The throne is an emblem of a nation's perpetuity. It was so with the Jews. Dr. Thompson seemed to favor having a throne in our country because of its moral influence. Agnosticism and materialism are the enemies of liberty, since they take away belief in a sovereign, personal God, to whom all men are ultimately responsible. On this belief is based the doctrine that the authority of the Nation is delegated and therefore limited. The nation is responsible to God for the realization of human rights. While combating communism the lecturer insisted that the rights of man were superior to the rights of property.

LECTURE VI. treated of the School. The Jewish, Spartan and Athenian systems of

education were described and the historic origin of our present system was given. This was in the establishment of monastic schools in the sixth century, which developed into cathedral schools, and out of these grew the great universities of Europe. Turning to the early history of education in America, Dr. Thompson came to the present educational problems of this nation: shall education be by Church or State? shall it be secular or religious? shall the Bible be taught in the School? shall education be compulsory or voluntary? But for the divided condition of Protestant Christianity he would urge the church control of schools and the giving them a decidedly religious character.

LECTURE VII. discussed the Church, "the institute of humanity," the social end of the race. The futile attempts of the Empire and of the State to be the Church were shown, as well as the inadequacy of other substitutes, such as masonic orders and the like. The idea of the Church versus sects was emphasized and the present divisions of the Church were deplored, especially here in America, where, however, although multitudes of denominations exist, few originated. We receive from Europe by importation every small sect that arises there. The rest of the lecture was given to an account of the activities of the Church, in worship, word, and doctrine; the care of the poor; woman's work, and the excessive and injurious organizations of parallel societies to do the work properly belonging to the Church itself as an organization.

LECTURE VIII. closed the course with a treatment of the Church and its social problems; its relations to the Family and the State; to education, and as a social mediator between conflicting classes and interests. The consummation of society in the Church of the finally redeemed, and the social character of the future life were

glowingly depicted, with the influence of this ideal on earthly conditions.

The lectures were attended by large audiences and were listened to with undivided attention. The course gave great satisfaction.

PRINCETON AND THE MARINE BIOLOGICAL LABORATORY.

The trustees of the Marine Biological Laboratory of Woods Holl, Mass., are preparing a circular inviting the co-operation of a number of the American colleges in support of the Laboratory, in the form of subscription to one or more tables. A similar plan has worked very successfully in Dr. Dohrn's Marine Station at Naples, which is mainly supported by the universities of Italy, Germany, Austria, Switzerland and Holland, aided by subscriptions from the various governments. The attendance at Naples is thoroughly cosmopolitan, and it is the intention of the trustees of the Marine Biological Laboratory to make it thoroughly national.

The details of the circular, which will be sent to the colleges, have not been published, but the plan is to propose that they subscribe from \$100 to \$200 a year with the privilege of placing one or more students at what are known respectively as the Students' or Investigators' tables. It will be readily seen that this privilege could be held out to biological students in the form of a prize for special honor work, and it appears to be thoroughly practicable.

The present organization of the Laboratory is due mainly to the energy of Professor Whitman of Clark University, the present Director, and of the Board of Trustees, which consists of a number of actively interested biologists residing in and near Boston. Dr. Osborn of Princeton and Dr. E. B. Wilson of Bryn Mawr have recently been added to the Board.

The large number of advanced investigators who are yearly attracted to the Laboratory constitutes an informal faculty, so that the student beginning upon a line of investigation has the advantage of skillful assistance and advice. A regular course of evening lectures was instituted last summer, two of which were given by Professors Libbey and Osborn. The Laboratory is adjacent to the U. S. Fish Commission building and Col. McDonald, the Commissioner, is thoroughly sympathetic with its aims. Princeton, thanks to Professor Libbey, has a table in the U. S. Fish Commission Laboratory, but it has been found by experience that few students are capable of taking advantage of the fine facilities here offered without considerable previous training in sea-side work. It seems therefore extremely important that Princeton should respond to the appeal and secure at least one or two tables in the Marine Biological Laboratory. The use of these tables could be extended to students immediately upon graduation, who would thus become qualified to work independently in the U. S. Laboratory in the following year.

The interest of an endowment fund of \$2,000 would permanently secure a table.

THE BIOLOGICAL CLUB UNIVERSITY LECTURES.

The two University lectures, arranged by the Biological Club, were very successful in point of attendance and the interest aroused. The first lecture, upon the 16th of March, by Dr. Benjamin Sharp, Corresponding Secretary of the Academy of Natural Sciences of Philadelphia, was based upon six months of travel and study among the West Indies. The photographic views were principally of the coast scenery, the mountain flora and the volcanic craters. He concluded by reading the first full account which has been pub-

lished of the great eruption upon the island of St. Vincent.

The second lecture was by Dr. Georg Baur, a lecturer in Clark University, upon the Galapagos Islands. He gave a very detailed description of the peculiarities of the remarkable fauna of these islands in support of the hypothesis he has advanced that the islands are due to subsidence rather than to elevation and that at one time they constituted a large land area which was probably connected with the main land. He accounted in this manner for the harmonic condition of the fauna upon the widely scattered islands, and for the presence of the peculiar reptiles and birds by migration over land from the South American Continent, rather than by Wallace's theory of their accidental transportation by water.

Dr. Baur proposes to explore these islands during an expedition of six months and he is seeking to collect funds for this purpose. He will require altogether between \$1,500 and \$2,000 and has secured \$300 from the Elizabeth Thompson fund with some promise of further support from Boston naturalists. He would be very glad if the entire expedition could be fitted out by some University, and as Mr. Clark has declined to send it out from Clark there is a fine opportunity for Princeton to secure the credit and collections which would follow this extremely interesting exploration. Besides Dr. Baur, who will go as a zoologist, the party will need a botanist and a photographer.

THE MATHEMATICO-PHYSICAL CLUB.

In the fall of 1889 a mathematico-physical club was organized by the younger instructors and graduate students in mathematics, physics and astronomy. As the club proved a success it was reorganized last fall and has met fortnightly since November. The programme for each evening

has included reports of original work and on the current literature of mathematics, physics, and astronomy, and the reading and discussion of a paper prepared by one of the members. The following are the titles of the papers which have been read this year: The Sheldon Experiment, by S. T. Dodd; Number and Numeral Symbols, by H. B. Fine; The Von Ettingshausen Experiments, by G. L. Shearer; Induction and Probability, by H. C. Warren; Linear Differential Equations, by J. M. Brooks; Molecular Theory of Temperature, by W. F. Magie; The Manner of Rotation of the Planet Venus, by Taylor Reed; Relations between the Sigma and Theta Functions, by H. D. Thompson; Functions which do not admit of a Differential Coefficient, by C. B. Williams.

APPARATUS FOR THE HISTORY OF ART.

The following additions have been made to the apparatus of the department of Archaeology and the History of Art:

1. *The Arundel Collection of casts of ivory carvings.* This collection is most valuable for the history of Mediæval sculpture, for it contains a continuous series of works beginning with the Christian era and ending with the Renaissance. The period between the sixth and the middle of the eleventh century A. D. was almost entirely lacking in works of monumental sculpture and the only means of filling this gap of some five hundred years in plastic history is by the study of the ivory carvings which never ceased to be executed in the East and the West. The Arundel Society's collection of casts is one of the largest and perhaps the most carefully executed of any such collection. The classes of objects included are mainly: consular and

ecclesiastical diptychs; panels; pyxes; book-covers; caskets; reliquaries; statuettes; triptychs; pastoral staffs; mirror-cases. They are taken from originals in many public and private collections in England and on the Continent. The schools represented are: Roman; early Christian; Byzantine; early Italian and French; Carolingian; Anglo-Saxon; early German; Lombard; Romanesque, of the French, Italian and German schools; Gothic, of the French, Italian, English, German and Flemish schools.

2. *The Braun collection of photographs.* This collection, recently purchased in Paris, from the estate of the French writer Paul de St. Victor, includes some seven thousand out of the total of about eleven thousand photographs that compose the Braun collection. A small number are of sculpture, such as the Parthenon sculptures and the Musée des Antiques, but the bulk reproduce frescoes, tempera and easel paintings and original drawings by the old and modern masters in many of the principal collections. They are taken by the well-known carbon process, which is not only unalterable, but has no equal as an adequate reproduction of paintings and drawings. They are generally of large size and are for the most part handsomely bound in half-morocco albums according to museums. The collections represented are: the Louvre; the Museums and Galleries of Vienna; of Colmar; of Weimar; of Basle; of Oxford; of Florence: of the Hague; of Madrid; of the Luxembourg; the National Gallery, London; Venice; besides special exhibitions, like those of the Trocadero in 1878, of Alsace-Lorraine, etc. The history of painting from Giotto to the middle of this century is represented, very fully for Italy and France; less so for Germany, Flanders and Spain.

ORIGINAL CONTRIBUTIONS.

THE ACTION OF AMMONIUM HYDRATE
ON PENTASULPHIDE OF ARSENIC.

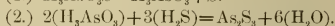
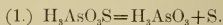
By L. W. McCAY.

1. Pentasulphide of arsenic, prepared by decomposing with a mineral acid a solution of sodium sulpharseniate, filtering off the yellow precipitate and washing it with water and absolute alcohol, is, while still moist, completely soluble in ammonium hydrate.

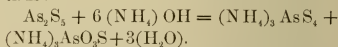
2. Pentasulphide of arsenic, prepared by heating arsenic acid saturated with sulphuretted hydrogen under pressure, filtering off the yellow precipitate formed and washing it with water and absolute alcohol, is also, while still moist, completely soluble in ammonium hydrate. The test is best made by collecting some of the moist sulphide on the end of a glass rod and bringing it into 25–30 cm.³ of ammonia water contained in an ordinary test tube. If the liquid be then gently stirred with the glass rod a perfectly clear solution will be obtained. The solution is at first pure yellow; upon standing, however, or, upon heating, it becomes almost colorless. Under these conditions a separation of sulphur, such as was always observed by Berzelius and Nilson, never takes place. It is the alcohol which prevents the separation of these traces of sulphur.

The solution contains no arseniate of ammonium, for magnesia mixture produces in it no precipitate. Nor is this precipitation hindered by the presence of the ammonium sulphosalt: for if a few drops of a dilute solution of arsenic acid be added to the ammoniacal solution of the sulphide and then magnesia mixture, there appears almost instantaneously a crystalline precipitate of ammonium magnesium arseniate. If the ammoniacal solution of the sulphide be strongly diluted, cooled

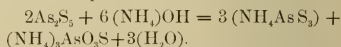
with ice, acidified with a mineral acid, shaken violently and filtered, and the filtrate treated with a rapid current of air until all the sulphuretted hydrogen has been driven out, it will be found to contain, especially when a pentasulphide prepared according to 2. has been used, large quantities of sulphoxyarsenic acid. Pentasulphide of arsenic prepared according to 1. contains sulphuretted hydrogen; there is formed, therefore, during the solution in ammonia, a relatively large amount of sulphosalt—consequently, less sulphoxysalt. During the action of the current of air the filtrate, provided the temperature be low enough and the degree of dilution just right, remains clear, and gives no precipitate with sulphuretted hydrogen: If it be boiled, however, it clouds up, sulphur is deposited and sulphuretted hydrogen produces in the filtrate from the sulphur a precipitate of arsenic trisulphide:



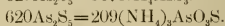
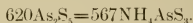
The original solution contains, therefore, ammonium sulpharseniate and ammonium sulphoxyarseniate. At first I was inclined to represent the reaction thus:



The lack of sulphur, however, renders it probable that a meta rather than an ortho compound is formed—thus:



A method for separating sulpharsenic acid from sulphoxyarsenic acid recently worked out by me makes it an easy matter to test the correctness of the last equation. From the above we have:



Now, given a known weight of pure pentasulphide of arsenic we can, on the supposition that the last equation is correct, calculate the amount of the sulpho and of the sulphoxysalt formed, and after dissolving this known weight in ammonia and heating gently to complete the reaction, separate the sulpho from the sulphoxysalt and, by weighing the corresponding equivalent quantities of pentasulphide, arrive at the amounts of sulpho and of sulphoxysalts which were actually present in the solution. If the results obtained by analysis agree with those required by theory, the equation should be correct.

I have made two separations with the view of settling this point. In the first experiment only the sulphosalt was estimated, in the second both the sulphosalt and the sulphoxysalt were determined.

I.

Taken 0.203 g. $\text{H}_2\text{KAsO}_4 = 0.1748 \text{ g. As}_2\text{S}_5$.

Calculated,

0.1311 g. $\text{As}_2\text{S}_5 = 0.1198 \text{ g. NH}_4\text{AsS}_3$.

Found,

0.1301 g. $\text{As}_2\text{S}_5 = 0.1189 \text{ g. NH}_4\text{AsS}_3$.

II.

Taken 0.2022 g. $\text{H}_2\text{KAsO}_4 = 0.1741 \text{ g. As}_2\text{S}_5$.

Calculated,

0.1306 g. $\text{As}_2\text{S}_5 = 0.1194 \text{ g. NH}_4\text{AsS}_3$.

0.0435 g. $\text{As}_2\text{S}_5 = 0.0146 \text{ g. (NH}_4)_3\text{AsO}_3\text{S.}$

Found,

0.1305 g. $\text{As}_2\text{S}_5 = 0.1193 \text{ g. NH}_4\text{AsS}_3$.

0.0442 g. $\text{As}_2\text{S}_5 = 0.0148 \text{ g. (NH}_4)_3\text{AsO}_3\text{S.}$

The facts then fit the theory, and there can be no doubt that when the pentasulphide of arsenic is dissolved in ammonia the resulting products are: Orthomonosulphoxyarsenate of ammonium, metasulpharsenate of ammonium and water.

—(Written for the *Chemiker Zeitung*.)

MEASUREMENT OF THE COEFFICIENT OF EXPANSION OF PLATINUM AND PLATINUM-IRIDIUM.

By SAMUEL T. DODD.

A series of measurements was made in the Physical Laboratory last June to determine the relative coefficient of expansion of some specimens of glass tube and platinum wire. A short account of the method and result was published in the November number of this journal.

A continuation of the same work was taken up in January of this year and measurements were made of the coefficient of expansion of some specimens of platinum and platinum-iridium. The specimens were in the form of small bars about 61 cm. in length and 6 mm. by 2 mm. in diameter. The method was practically the same as that employed last year and described in the paper referred to above.

Two slight changes were introduced. The microscopes by which the expansion was read were detached from the bed-plate of the comparator and fastened to a steel bar. This bar was kept packed in melting ice or snow so that there was no necessity for introducing any correction for variation in the distance between the microscopes due to variations in the temperature of the room. Measurements were made not only at the temperature of the room and 100° , but also at one or two intermediate temperatures. In order to obtain these, water at the required temperature was passed through the tube surrounding the bars.

The course of one complete set of readings was then as follows: the bar was taken at the temperature of the room, the cross-hairs of the microscopes set on the fixed scratches near the ends of the bar and the reading of the micrometers taken. Then water at some fixed temperature, say 50° , was allowed to flow through the tube; the cross-hairs were again set on the

scratches, and the difference between the micrometer readings in the two cases gave the expansion for that change in temperature. Next steam was passed through the tube and the readings taken. Then another reading was taken at an intermediate temperature and finally at the temperature of the room.

One complete set of readings such as these took from four to six hours. Three sets were taken on each of the three bars.

The results obtained, though agreeing very well with each other, are higher than those obtained last summer for the coefficient of platinum wire. The difference which appeared in that work between the coefficient of expansion and coefficient of contraction does not appear in these results. One other peculiarity of the results might be noticed, that is that they give a higher value for the coefficient of platinum-iridium than for that of pure platinum, while the coefficient of iridium is lower than that of platinum. It would be expected that the coefficient of the alloy would be intermediate between those of the components.

The temperatures intermediate between that of the room and 100° were taken in order to obtain, if possible, some idea of the rate of change of the coefficient with increase of temperature. Then knowing the length at any temperature a° , the length at any temperature t° will be given by the formula

$$L_t = L_a[1 + a'(t-a) + a''(t-a)^2].$$

In the case of Bar No. 1 the intermediate readings were too inconstant to give this; but for the other two bars the values of a' and a'' have been obtained ($a=15$) as well as the average coefficient between 13° and 100° .

Bar No. 1. Pure Platinum.

Average coefficient between 13° and 100° ,

$$9.153 \times 10^{-6}$$

Probable error $\pm .023 \times 10^{-6}$

Bar No. 2. Platinum with 5% Iridium.

Average coefficient between 13° and 100° ,

$$9.444 \times 10^{-6}$$

Probable error $\pm .015 \times 10^{-6}$

$$a' \dots 9.123 \times 10^{-6}, \quad a'' \dots .0036 \times 10^{-6}$$

Bar No. 3. Platinum with 10% Iridium.

Average coefficient between 13° and 100° ,

$$9.566 \times 10^{-6}$$

Probable error $\pm .044 \times 10^{-6}$

$$a' \dots 9.055 \times 10^{-6}, \quad a'' \dots .0055 \times 10^{-6}$$

SUMMARIES OF PAPERS READ BEFORE SCIENTIFIC SOCIETIES.

ROBERT BROWNING.

By T. W. HUNT.

After giving a brief sketch of Mr. Browning's Life and Literary Work, Professor Hunt discussed the subject under four or five leading topics, as follows:

His Poetic Personality, as thoroughly unique.

His Intellectuality as a poet, expressed, too often, in the extreme forms of abstruse speculation.

His Dramatic Character and Work, in which the subjective element is too prominent for the highest result.

His Claims as a Poetic Artist, impossible, at times, to substantiate.

The Obscurity of his Thought, Structure and Diction, in violation of all established law.

Attention was called, in closing, to Mr. Browning's present and prospective status as a poet, and emphasis was laid upon the fact that English Verse was largely indebted to him in the line of mental stimulus and suggestion.

[Outline of Lecture delivered at Columbia College, March 7, 1891.]

THE NATURE OF TEMPERATURE.

By W. F. MAGIE.

By the use of a theorem in the kinetic theory of gases in connection with the fact that the energy of a gas is proportional to the temperature and is independent of the nature of the gas, it can be shown that temperature is of the dimensions of energy. The temperature of a body must be measured in some way by the intrinsic energy or part of the intrinsic energy of the body. This energy is subdivided into several parts: the potential energy due to molecular or atomic forces; the kinetic energy of the molecule due to its translation as a whole or to its rotation; the kinetic energy of the atom due to its vibration about the centre of the molecule. It is very likely that in solids and liquids molecules combine to form larger molecules or molecular groups. In this case the division of the energy of a body can be carried still further.

Now on the kinetic theory of matter raising the temperature of a body increases its energy, and in general increases every one of the parts into which the total energy is divided. One exception to this rule is demonstrated by Loschmidt, who shows that the mean potential energy of the atoms in a molecule may diminish as the mean kinetic energy of the same increases with the heating. Since temperature manifestly is a function of some one or more of the kinetic energies of the body this exception is of no importance in the present discussion. There are really only two of these energies which furnish a probable measure of temperature; the energy of translation of the molecule, and the energy of vibration of the atom about the centre of the molecule. The object of this paper is to present the arguments for and against the latter measure of temperature.

1. If the temperature is a function of the atomic vibration we can explain the

relations of temperature to radiant heat and light. After the proof by Hertz of the existence of electro-magnetic waves we need not hesitate to assume that light is an electro-magnetic disturbance, probably set up by the rapid vibrations of the electrically charged atoms of the molecule. The facts of electrolysis show that such oppositely charged atoms do exist in the molecules of bodies and that they are capable of carrying their charges with them. The electrical discharge in gases and the relations of the discharge to the pressure, temperature and character of the gas are explained by Schuster and J. J. Thomson on the same assumption. The rapid vibration of these atomic charges will set up the rapidly alternating current elements needed as the source of the electro-magnetic waves. This explains very readily the increase of intensity of radiation with the rise of temperature. For the intensity will be proportional to the square of the mean strength of current set up by the vibration and this will be proportional to the square of the velocity of the moving atom. It does not explain the fact that the molecules and consequently, by Maxwell's and Boltzmann's theorems of the constant distribution of internal and translatory energy, the atoms of different gases have the same kinetic energy when at the same temperature. To explain this further hypotheses have to be made.

2. Dulong and Petit's law that the product of the atomic weight by the specific heat is a constant for most of the solid elements and is a different constant for gases, and Neumann's extension of that law to compound bodies, show that an atom of any element requires a certain fixed amount of heat to raise its temperature one degree. The specific heats used in the establishment of these laws measure the total energy entering into the body during the rise of temperature and not the kinetic energy of the atom alone. The

law holds in the case of gases for the reason that, as already cited, the energy of vibration of the atom of a gas is in a constant ratio to the energy of translation of the molecule, so that a constant fraction of the specific heat measures the atomic energy; and it holds in the case of solids because the increase in the energy of molecular translation and the potential energy gained by expansion are both very small as compared with the atomic energy, so that the specific heat measures approximately the atomic energy.

3. The processes of fusion and evaporation are explained consistently by this theory. As heat enters, this theory asserts that the atomic energy increases proportionally to the temperature, and the molecular energy of translation increases faster, until the substance melts. The conception developed by Eddy explains the heat used up in fusion as the energy imparted to the molecules to carry them from a vibration in which they possess a maximum mean kinetic energy to a rotation in which they again possess the same kinetic energy. On melting, the body's specific heat increases; part of the energy introduced goes into atomic and part into molecular energy. That the molecules of a liquid move with great velocities is rendered probable by the enormous mutual attractions existing between them, and by the known high velocities of the molecules of gases. The molecular velocities in the liquid are greater than those in its vapor, and corresponding to that, when the liquid evaporates and a quantity of heat is used to increase the potential energy of its molecules, its specific heat diminishes. That is, the molecular energy becomes a smaller percentage of the total energy. The increase in the specific heat as the temperature of the vapor is raised is probably due to dissociation.

From the ratio between the specific heats of a liquid and of its vapor the ratio be-

tween the molecular energy in the two states may be calculated. The molecular energy of the liquid is thus shown to be considerably greater than that of the vapor.

4. The theory of this paper meets with difficulties when it is applied to the case of vapors which radiate heat and which are yet monatomic or are assumed from their chemical behavior to be monatomic, and it requires the use of additional hypotheses to explain the departure of some elements from Dulong and Petit's law. Most, if not all, of these abnormal substances have band spectra at low temperatures, showing a mode of molecular vibration which is not simple and regular. Their abnormal relations may be due to this fact.

[Read before the Mathematico-Physical Club, February 19, 1891.]

NOTES ON SEX IN THE LOWER ANIMALS AND PLANTS.

By GEORGE MACLOSIE.

Our belief that God when creating organisms gave them their distinctive characters is consistent with our endeavoring to discover how they are related to each other and to the general order of nature; and only thus can we understand the comment that what was made was "very good." It is only within the last century that the general existence of sexual distinctions among plants as well as animals has been definitely known; and whilst a great deal has been written as to what may be termed the secondary sexual characters, the fundamental distinction involved is as yet a mystery. It would appear that the three processes of growth, non-sexual reproduction, and sexual reproduction, are closely correlated, and inter-dependent. Growth by the ingestion of food enlarges the size so as to bar its own continuance, and would come to a deadlock if there were no counteracting process by which the size may

be reduced and new individuals formed. Crystals which arise spontaneously in fluids, also disintegrate spontaneously; but organisms are not known to arise except by germs, and their life ends in germs as it began, only with a residual part that may survive for a time. The behavior of the cell-nucleus in the production of spores or of ova and sperm-cells is apparently homologous with its behavior in the ordinary processes of cell-multiplication incidental to growth. Thus reproduction seems to be a special kind of growth, with incidentally a partial dissolution of the organic partnership and a colonization of the new forms. There is commonly a division of labor as to time, the growth occupying the active period, and the various methods of reproduction occurring during a state of rest; in some groups the non-sexual and the sexual processes are thus differentiated, vast numbers of offspring being produced partheno-genetically during the summer, and a few fertilized ones appearing in the fall, to survive the winter and to appear as healthy individuals next spring. Sexual reproduction, though thus often alternating with a different system, seems to present no fundamental diversity. The two kinds of reproductive cells, ova and spermatozoa, though externally diverse, appear to us to be of essentially the same nature. In cases of what is called *conjugation* they are alike; in some low plants both ova and sperm-cells may grow independently, the offspring, however, being only weaklings; in some instances the ova of two different animals have been made

to fertilize each other; and it has been found that specially good food has the effect of making tadpoles become nearly all of them females. The chief distinction appears to be a physiological division of labor. The ovum is large, having a store of nutriment for the young offspring, hence it is not active, but has a large nucleus for the control of its mass; before fertilization a part of this nucleus (like the macronucleus of infusoria) separates and is extruded as 'polar bodies.' The sperm-cell has little nutriment, and is small, locomotive (either passively carried about, or provided with cilia and eye specks that are sensitive to light), and thus it serves to *cross* different individuals, the beneficial effect of which seems to be proven, though we cannot say why such intercrossing is helpful. The sperm-cell appears in its formation to result from nuclear division carried to a lower stage than with the ovum; and hence no further division is called for, and no polar bodies are known. Both ovum and sperm-cell may be regarded as an intermediate generation of the organism. Lubbock found that the sperm-cells of ants retained their vitality for thirteen years; and it is known that the ova of some animals can move and take in food, behaving for a time like independent animals. In the process of impregnation the usual course of nuclear division is reversed for a stage; two nuclei combine into one, which unites the characters and in some measure the vigor of both constituents.

[Read before the Princeton Science Club, February 11, 1891.]

SUMMARIES OF PAPERS PUBLISHED.

PROF. SHELDON'S EXPERIMENT ON
THE "MAGNETO-OPTICAL GENERATION OF ELECTRICITY."

By C. F. BRACKETT and S. T. DODD.

(There appeared in the *American Journal of Science* last September an article by Professor Sheldon under the above title. The experiment he described was the converse of the Faraday experiment on the rotation of the plane of polarization, and was carried out briefly as follows: a coil of insulated wire was wound on a small brass tube and a telephone connected to the ends of the coil. A ray of polarized light, after reflection from a small mirror, passed through the tube. The mirror was arranged to oscillate through an angle of 45° about 300 times per second. "The plane of polarization was thus twisted through twice that amount, or 90° , in the same time," and a musical note was thereby produced in the telephone.)

During last November and December we endeavored to repeat his experiment and also to obtain the same result by other similar means, but with entirely negative results.

We first followed as nearly as possible the arrangement of Professor Sheldon; the only essential change which we made was in the substitution of a glass tube for the brass one upon which the coil was wound. The experiment was carried out with the result that faint musical sounds were heard in the telephone, which could be referred either to the action of the arc lamp or to the moving machinery. On interrupting the ray of light, no change whatever was produced.

We next discarded the oscillating apparatus and substituted one by means of which we could rotate the Nicol prism, about 200 times per second. For, if Professor Sheldon's reasoning be correct, a rotation of the plane of polarization through 360° , 200 times per second, ought to pro-

duce an electro-motive force higher than would be produced by the oscillation of the mirror reflecting the beam 300 times per second. We failed however to obtain any indication of a direct current by the use of a delicate galvanometer, or of an interrupted current by means of a telephone when the ray of light was rapidly and periodically interrupted.

In the third place, if an electro-motive force can be induced by mechanically superimposing a third rotation upon the two existing rotations, which are regarded as the equivalent of a plane polarized ray, then a still greater electro-motive force should be induced by suppressing one of the original rotations; that is to say, by using circularly polarized light. Accordingly this plan was employed and with negative results.

The criticisms which we would make on the experiment are:

(1) That an oversight has been made, by Prof. Sheldon, in a matter of such extreme delicacy, in the employment of a conducting core for the helix instead of a non-conducting one.

(2) That an arc light is wholly unsuited to be employed in such an investigation. Finding that the currents set up in the helix, by the variations of the magnetic field about the arc, were sufficient to mask any effect that we might hope for, we were forced to employ the calcium light instead.

(3) Prof. Sheldon does not state the material of which his mirror was made. If it was of glass, Fresnel's formulæ for the reflection of polarized light would show that, at an incidence of 80° to 85° , a rotation of the mirror through an angle of 45° would only produce a rotation of about 10° in the plane of polarization of the reflected beam. If the mirror was silvered, according to Jamin's experiments on metallic reflection, the reflected beam would be plane-polarized only in case the angle between the planes of polarization

and reflection were 0° or 90° . So that whatever the disturbance may have been which Professor Sheldon noted in the telephone, it was not due to a rotation of the plane of polarization through an angle of 90° , 300 times per second.

[Reprinted from *The Electrical Engineer*, December 24, 1890.]

THE OSTEOLOGY OF POEBROTHERIUM AND DESCENT OF THE CAMELS.

By W. B. SCOTT.

The careful comparative study of the series of fossil mammals promises to be of great assistance in solving several of the difficulties and open questions which at present obstruct the application of the theory of evolution to concrete cases. When morphological works are examined it is found that a large part of their reasoning is founded upon tacit assumptions, which are often fundamentally different in the case of different writers. Some of these assumptions may be thus enumerated: (1) Are genera of single or multiple origin? (2) How far is parallelism of structure possible? (3) Is there any convergence of development? (4) Can a structure which has once been lost ever be regained? (5) Is the differentiation of any group a steadily advancing one, or is it not rather progress in a spiral, now advancing and now retrograding? (6) Is the differentiation of the higher animals always by means of the reduction of parts? (7) Is the reduction of parts always accomplished in the same way? (8) What effects follow from increase or decrease of size?

These questions all refer to the *mode* in which evolution operates. Another class of problems, even more important, refers to the *factors* or efficient causes of the process, and especially as to the transmission of acquired characters, and the causes of variation.

The two mammalian series which are best fitted to throw light upon these problems are the camels and the horses, because of the remarkably complete specimens which the various Tertiary formations of the West have furnished. In the former the succession of genera is as follows: In the Wasatch we find *Pantolestes*, in the Bridger *Homocodon*, in the Uinta *Leptotragulus*, in the White River *Poebrotherium*, in the Deep River *Protolabis*, and in the Loup Fork *Procamelus*. The paper is taken up with a minute examination of the structure of these successive genera; the second paper of the series will deal in the same manner with the horses and will attempt to apply the results gained to the solution of the evolutionary problems already enumerated.

[Abstract of a paper in the *Journal of Morphology*, Vol. V.]

A REVIEW OF THE CRETACEOUS MAMMALIA.

By HENRY F. OSBORN.

This review is a critical analysis of two important papers, which were published in 1889, by Professor O. C. Marsh, of the U. S. Geological Survey, announcing the discovery of the Cretaceous Mammalia. These papers contained descriptions of a large collection of isolated teeth, supposed by the author to be representative of four orders and a great variety of genera and species, giving the impression that the fauna was very extensive and novel. The main object of the review is to demonstrate, as far as the study of the author's descriptions and figures will allow, that the author has based by far the greater part of his determinations upon teeth belonging in different regions of the upper and lower jaws of the same species. The author's figures of his types are placed together and reproduced in such a manner

as to show that in some cases three families, six genera and seven species have been founded upon teeth which might possibly have belonged in the same skull. Thus the extensive faunal table, as given by the author, is decimated and reduced to a few genera and species.

The review was first read in Boston, December 29th, before the Society of Morphologists, then before the Philadelphia Academy and finally before the Biological Society of Washington, February 6th.

[Proceedings of the Academy of Natural Sciences of Philadelphia, January 20, 1891.]

PRELIMINARY OBSERVATIONS UPON PALÆOSYOPS AND ALLIED GENERA.

By CHARLES EARLE.

The E. M. Museum contains a collection of specimens belonging to the genus *Palæosyops*, which is probably the most complete in the country. These fossils were mainly found in the Bridger and Washakie Eocene beds by the expeditions of 1877-78. The species of this and allied genera have been in a state of hopeless and increasing confusion ever since 1870, when the genus was established by Leidy. This confusion

has arisen from the fact that five authors, Leidy, Marsh, Cope, Scott and Osborn, have attempted to define the allied genera and species without examining the type specimens upon which previous descriptions were based.

Mr. Earle began his investigations last year by a round of visits to the National Museum, the Philadelphia Academy, the Cope Collection and the Yale College Museum, making careful studies and comparisons of all the types, with the result that he has been able to give in the present paper a complete descriptive analysis, which is of very great value. He reduces the number of genera to three, namely, *Palæosyops*, *Telmatotherium* and *Limnocyops*, including eleven species.

The present paper, however, is merely a brief preliminary abstract of a large monograph upon this genus, which the author has nearly ready for publication. This will be illustrated by lithographic figures of all the main types, showing the peculiarities of the skeleton and teeth in the different forms and including a restoration of *Palæosyops paludosus*.

[Proceedings of the Academy of Natural Sciences of Philadelphia, January 27, 1891.]

REVIEWS OF BOOKS.

THE DEVELOPMENT OF THE DOCTRINE OF INFANT SALVATION. By Benjamin B. Warfield. New York: The Christian Literature Co. 1891.

In this small work of 51 pages Dr. Warfield does not attempt "to unravel the mystery of opinion as to the salvation of infants dying in infancy, but to trace the development of doctrine on this subject." This he succeeds in doing very clearly. He first considers the patristic doctrine which made baptism essential to salvation and thus excluded all unbaptized infants

from the kingdom of heaven, with the exception of infant martyrs. This doctrine was transmitted to the mediæval Church, but was by it mitigated by assigning to infants *poena damni* and not *poena sensus*, and still further by the application of the "baptism of intention." In a third section the teaching of the Church of Rome is given, which was that of *poena damni*, softened by definitions of this punishment. Individual Catholic theologians came near positing salvation for all infants dying in infancy. The Lutheran doctrine, as con-

tained in the Augsburg Confession, makes baptism essential to salvation, excluding unbaptized infants, with exceptions founded on divine mercy. Baptism of intention is recognized. A "cautious agnostic attitude" as to the salvation of unbaptized infants is the historical Lutheran attitude. The Anglican doctrine at first denied the salvation of unbaptized infants, but later was content with not asserting their salvation. There were five opinions among the Reformed: 1. All dying infants saved; 2. Uncertainty as to all; 3. All covenanted saved; 4. All covenanted and some others saved; 5. Agnostic attitude as to the uncovenanted. Dr. Warfield holds, as against Prof. Shields, that Calvin believed that some infants dying were lost. He claims that "the cautious agnostic view" is the general Calvinistic one. Nearly all modern Calvinists believe in the salvation of all infants dying in infancy, because of God's electing love. In a seventh section the "ethical" tendencies of the various views are discussed. The danger of the modern notion of man's natural innocence is shown, as well as the logical inconsistencies of the Remonstrants and Wesleyan Arminians, and of the advocates of future probation. All views are summarized in three: (1) an ecclesiastical doctrine, (2) a gracious doctrine, and (3) a humanitarian doctrine. The second is the doctrine of the Reformed churches. The thinking of the Christian world is toward the conclusion that all those that die in infancy are the elect children of God, and this may be logically maintained on the basis of the Reformed doctrine, and only on that basis. The confirmation of this view is the third step in the development of the doctrine of infant salvation. Dr. Warfield's brochure will be found very helpful to a distinct understanding of the subject discussed.

J. H. DULLES.

LESSONS IN ASTRONOMY, including Uranography; a brief introductory course without mathematics for the use of schools and seminaries; by Charles A. Young, Ph.D., LL.D., Professor of Astronomy in the College of New Jersey (Princeton). Boston, 1891: Ginn & Co.

This work is essentially an abridgment and simplification of the "Elements of Astronomy," by the same author. It is intended for the use of those whose mathematical training has been limited or whose time available for the study of astronomy does not warrant an attempt to master the larger work. To such the author has endeavored to make the work intelligible and useful by omitting those mathematical processes which in even fundamental astronomy are requisite to an understanding of the establishment of many of the results, but yet are not necessary for a comprehension of most of the results themselves.

Care has been taken not to push compactness to the point where it becomes inconsistent with accuracy. And the most recent important results of astronomical investigation have been scrupulously included.

While the whole has been rewritten the general arrangement of the book remains in most essentials similar to that of the "Elements." Among the deviations the most conspicuous are in the placing the Uranography in the body of the text, and near the beginning; and in introducing mythological explanations of uranometrical nomenclature.

TAYLOR REED.

THE NUMBER-SYSTEM OF ALGEBRA. By Henry B. Fine, Ph.D., Professor of Mathematics in Princeton College. Leach, Shewell & Sanborn, publishers. Boston, 1891.

In this small but comprehensive book are given the theoretical basis of the number-system needed for the solution of alge-

braic equations and an historical account of the introduction into mathematics of the various forms of number making up this system.

The theoretical part opens with a study of the number concept, based on the primary cognition of separateness, and of counting as being the setting-up of a one-to-one correspondence between individuals of two groups. The commutative and associative laws for addition and the additional distributive law for multiplication follow as consequences of this view of number. Subtraction, considered as the inverse of addition, is shown to be determinate, and to have no meaning so long as the numbers correspond to real things, unless the minuend is greater than the subtrahend. The formal rules for subtraction hold, however, in any case, and by the use of the principle of permanence and an enlarged definition of the equation, a symbolic definition of subtraction is obtained which is general. Hence follows the introduction of the new symbols, zero and the negative, the latter of which admits of no interpretation in terms of real things, at least without the use of conventions lying outside the domain of pure arithmetic. A similar study of division as the inverse of multiplication leads to the adoption of the fraction as an additional number-form, which completes the system of rational numbers. By the use of Cantor's method of defining a number by a regular sequence, a new concept, that of the irrational number, is introduced and developed. The imaginary is shown to be necessary to express the results of certain operations, and the complex number is discussed and shown to furnish an adequate number-system for algebra, and indeed for all existing mathematical operations.

In a study of the representation of a number by the length of a line drawn from an origin, the important theorem is

proved for the first time that there is a one-to-one correspondence between numbers defined by regular sequences and the points of a line. The system of real numbers is therefore continuous, in the same sense in which a geometrical magnitude is continuous. The representation of complex numbers by the points on a plane is followed by the definitions of sine and cosine, by the demonstration of Demoiivre's theorem, and the relation between these trigonometrical functions and the base e .

The discussion of infinite series, both real and complex, as defining numbers, includes a study of convergence, the tests for it, and the limits of it, and the proof of the applicability of the fundamental operations to converging series. In order to secure general definitions for evolution and involution, after the definition of a function and the presentation of the theorem of undetermined coefficients, the exponential function, the sine and cosine, and the logarithmic function are developed and their properties studied.

The historical portion opens with an account of primitive numerals, in which the author advocates the view that the first numerals were cardinals and the first counting the establishment of a one-to-one correspondence between the members of the group to be counted and the members of some representative group, like the fingers or some set of marks, of which the similarity was so great that their separateness was the most conspicuous thing about them.

In the account of systems of notation it is shown that our modern written numbers were developed, probably, from letters in an Indo-Bactrian alphabet of the second century B. C.

After the account of the various ancient notations for the fraction, and of the discovery of the irrational by Pythagoras, with its consequences for the Greek geometers in divorcing completely algebra

and geometry, follows the history of the equation, as treated by the Greeks, the Indians, the Arabians and the Europeans of the Renaissance, and of the development of algebraic symbolism and of the introduction of the negative and the imaginary into mathematics. In connection with this come accounts of Descartes' use of the negative, his interesting "algebra of line-segments," Newton's and Euler's use of the continuous variable and the general irrational, Argand's and Gauss's representa-

tions of the imaginary and complex number. Finally are presented Peacock's thorough exposition of the principle of permanence, and Gregory's definition of symbolical algebra, with its implication that an algebra might possibly exist in which the formal laws of the algebra of number should not hold. This definition was soon justified by Hamilton's and Grassmann's new algebras, in which the commutative law did not hold for multiplication.

W. F. MAGIE.

NOTES.

Dr. Henry de Varigny is editing in Paris a series of contemporary discussions upon evolution, which will be called *Bibliothèque Evolutioniste*. The first number will contain translations of Mr. W. Platt Ball's "Are the Effects of Use and Disuse Inherited?" and of Dr. Henry F. Osborn's "Are Acquired Variations Inherited?" The latter paper was noticed in the last number of the BULLETIN and was the one presented before the Society of Naturalists at the recent Boston meeting.

The three recent meetings of the Princeton Biological Club have been devoted to papers upon the current questions of Heredity. The first was by Dr. Osborn, entitled "Are Acquired Variations Inherited?" The second, by Dr. Scott, upon "Maupas' Experiments upon the Generation of Infusoria." The third, by Dr. Macloskie upon "The Origin of Sex." The first paper has already been noticed. The second contained a very full *résumé* of the striking studies of Maupas upon the life history and conjugation of the single-celled organisms, especially in their bearing upon Weismann's views. Dr. Macloskie gave a review of the recent literature and speculations upon the problem of the differentiation of the sexes, advancing an original hypothesis in conclusion.

The '77 Biological Laboratory has recently received two handsome gifts from members of the class. The first was from Harvey E. Fisk, Jr., of New York, in the form of a subscription of \$300, the first step towards the permanent endowment of the Class University Fellowship. The second was from George A. Armour of Chicago, amounting to \$529.50. Of this sum, \$300 will be added to the Fellowship endowment fund. The balance will be used for the purchase of aquaria and other additions to the permanent equipment of the Laboratory. Both the subscriptions were made in recognition of the good work done by the Fellows and students of the Laboratory in the line of original investigation.

The Syllabus of the University Extension lectures on the History of Art by Prof. Allan Marquand, now being held on Saturday mornings and evenings at the Metropolitan Museum in New York and at Pratt Institute in Brooklyn, respectively, gives first the books of reference, and then brief notes of the topics of the successive lectures. The lectures deal with the following subjects: Lecture I, Egyptian Art. Lecture II, Assyrian Art. Lecture III, Greek Architecture. Lecture IV, Greek Sculpture. Lecture V, Roman Art. These

lectures bring the history of art down to the beginning of the Christian period, from which point the subject will be continued in five lectures on Christian Art by Prof. A. L. Frothingham, Jr. The audience at these lectures is composed mainly of teachers and art students.

The University Extension course of lectures on Astronomy by Prof. C. A. Young, is announced to be given in the main hall of the Cooper Union, on Saturdays in April, in the evening.

Prof. Young has lately given a similar course of University Extension lectures in Philadelphia.

The Metropolitan Museum of New York is about to organize a collection of casts of sculpture and architecture which promises to surpass in size and comprehensiveness anything hitherto made. Besides the Willard collection which is being made at a cost of \$100,000, and the Marquand collection of sculptural casts, it was resolved by a committee of gentlemen interested in the museum to endow it with a collection of casts, that together with those already mentioned, should represent in as complete a manner as possible the history of sculpture. The expense is to be \$100,000, of which \$60,000 have been already raised. The formation of the collection has been entrusted by the committee to Mr. Robinson, of the Boston Museum, for Ancient Sculpture, and to Prof. Frothingham for Christian and Renaissance sculpture.

The American Philological Association will hold its next meeting in Princeton, on July 7 to 9, 1891.

By the deed of gift of the residuary legatees of the Fayerweather estate, Princeton College receives \$100,000, less a small abatement which may be rendered necessary to provide for an increase in certain of the allowances granted in the original will, and also will eventually receive a tenth of the residue of the estate remaining after all the gifts now specified have been made.

The recount of the Library, now in progress, has shown up to date a total of 80,700 volumes.

In the April number of *Modern Language Notes* Prof. Hunt has a critique of Earle's English Prose.

Dr. Richardson read a paper at the meeting of the New York Library Club, February 12, on the Science of Books.

Prof. Marquand lectured lately before the local branch of the Archæological Institute in Baltimore, on the origin of Ionic Architecture. He also delivered an address before the recently organized branch of the Institute in Chicago.

On the occasion of the eightieth birthday of Dr. McCosh, the Faculty of the College presented him with a congratulatory address and a piece of plate as a testimonial of their affection and esteem. Other testimonial pieces of plate were also received by Dr. McCosh, from the Princeton Club of New York, and from those of his students who are instructors in American colleges.



ALBERT B. DOD HALL.

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. III.

JUNE, 1891.

No. 3.

ALBERT B. DOD HALL.

In the illustration accompanying this number of the *Bulletin*, we present a view of the latest addition to the number of the buildings upon our campus.

Mrs. Susan D. Brown, to whom both the College and Seminary owe so much, is again our benefactress. The new dormitory is named in memory of her illustrious brother, Albert B. Dod, who for many years was the professor of mathematics in Princeton. It forms one of a group of buildings which when completed will enclose another quadrangle similar to that bounded by old North, East and West Colleges, and the new Halls of the two Literary Societies. This latter quadrangle will be surrounded by an attractive series of buildings, notable for their handsome architectural features, but the historic interest will always center in the older group.

This new students' home is constructed upon plans which originated in the Curator's office and which were based upon the practical experience obtained by a careful study of the needs of collegemen. These plans were developed and completed architecturally by Mr. J. L. Faxon, of Boston. There are four main hall-ways which are large, airy and welllighted and from which suites of rooms open out, consisting of a study and one or two bedrooms, and offer accommodations for 75 students. It is constructed in the most substantial man-

ner of a very hard sand stone from Bull's Island near Trenton, and has cost the sum of \$75,000.

That the students appreciate what has been done for them in this instance, is witnessed by the fact that every room is occupied, showing it to be one of the most popular buildings upon the college grounds. The structure is a worthy memorial of a justly famous man; and one whom Princeton delights to honor in the hope that the recollection of his name and works may induce the students of this later day to emulate his brilliant scholarly example.

THE TRUMBULL-PRIME COLLECTION.

This collection has the honor of being the first collection of importance in this country to represent the history of pottery and porcelain and as such it finds a welcome place in Princeton, where special attention is paid to the study of the history of art. The collection is all the more welcome, since it was made by one of our graduates, Mr. William C. Prime, '43, whose lamented wife was also an enthusiastic and intelligent collector and student of ceramic art. It was her interest in the subject which led Mr. Prime to write his "Pottery and Porcelain of all Times and Nations," in which frequent reference is made to this collection. Designed to be a study collection which will fairly represent the workmanship of "all times and

nations," it does not profess to be a collection of curios.

As it is hoped that the collection will be on exhibition during Commencement week, we may give a brief survey of its contents.

There are specimens here of Egyptian pottery, chiefly small objects. But we find figures of various divinities, such as Isis, Horus, Thoth, Anubis; sacred animals, amulets of various kinds, scarabs and necklaces. Phœnicia is represented by a collection of 200 vases, both and Etruria by an historical series, both presented by Prof. Marquand. For Greece, we have a number of Corinthian *Aryballoi*, black figured and red figured *Kraters* and *Amphoræ* and a few examples from the late Greek period. China and Japan are represented by vases, figurines, bowls, tea pots and a fine collection of plates, and the nearer Orient by Asiatic and Persian bowls, Rhodian plates and pitchers, modern Egyptian soft pottery, Hispano-Moresque dishes and a number of tiles from Cairo, Jerusalem and Damascus. A large proportion of the collection is devoted to European wares. Here are samples of the fayence of central and northern Italy and examples from the Capo-di-Monte and other Neapolitan factories. Provincial France appears in the wares of Rouen, Lille, Creuil, Sceaux, Moustiers, Marseilles, Nevers, Niderviller, &c., while the royal factory at Sèvres is represented by very beautiful specimens. Wares from Switzerland, Austria, Hungary and Russia appear in the collection, a larger number from Holland and still more from Germany and England. In the German collection there is a fine assortment from the Dresden and Kronenburg factories, brilliant specimens from Berlin, and others from Nuremberg, Wallendorf, Fürstenberg, Ludwigsburg, Rudolstadt and Höchst. The cases devoted to English pottery present a series from

the early English wares down to the finest Wedgwood. One may follow here the various factories such as those in Bristol, Lowestoft, Liverpool, Derby, Chelsea, and Staffordshire, or trace in the figured subjects historic incidents; of the latter class the Washington, Lafayette, Hancock and other pitchers will be of interest, as also the plates preserving the pictures of early railroad and steamship travel. South America, as well as the United States, is represented by a few specimens.

The present arrangement in the cases is merely temporary, but with additional cases and a card catalogue it is expected that the collection will render a perpetual service as an object lesson in the history of art.

THE COLLECTION OF CASTS OF SCULPTURE GIVEN BY THE CLASS OF '81.

The class of 1881 will present to the College at its decennial, this Commencement, a collection of plaster casts of sculpture for the Museum of Art and Archaeology. The entire collection has been ordered and a large portion of it is already in the Museum, though it is not probable that all the casts can be arranged in time for exhibition during Commencement.

Limitations of space and funds allowed of but two plans in the formation of this collection; either it could be made to represent very completely the development of sculpture during some limited special period, such as the fifth and fourth centuries B. C. in Greece, or it could present, in a sketchy manner, the outline of the entire history of sculpture. The latter alternative was chosen, as more suited to a collection made expressly for the purpose of assisting the instructor in illustrating for students the history of sculpture. The period covered is some four thousand years, from early Babylonian times to the

close of the Gothic period. The Art of the Renaissance is not included because no adequate representation of it could have been secured within the present limits of the fund. It was felt that such an attractive, rich and distinct period might well tempt some friend of the College in the near future to complete the series by a special gift.

The scope of the collection will be best indicated by an enumeration of some of its representative pieces. For EGYPT there are a few heads and bas-reliefs for the Ancient Empire, the New Empire and the Saitic revival, including portraits of Aménophis, Thothmes III. and Rameses II. Early BABYLONIAN art is exemplified by two heads from Telloh; ASSYRIA by some reliefs of the reigns of Assurnazirpal and Assurbanipal from the British Museum, and by some pieces from Sargon's palace at Khorsabad in the Louvre; PERSIA by a couple of reliefs in the British Museum.

The fullest series is that devoted to GREECE. For the *archaic* period (700-470 B. C.), the Louvre furnishes the Perseus metope from Selinus and a seated Cybele; the British Museum the Stranford Apollo, the Demeter and Persephone of Zanthos; the Berlin Museum sends the Stele of Aristion, the Spartan relief, and a number of statuettes and of pieces found at Olympia. For the *developed* period (470-300 B. C.) only a few of the most noted can be mentioned. For Pheidias there are two figures from the gable sculptures of the Parthenon, two of its metopes and the entire frieze; also the Madrid puteal. Myron is represented by a reduction of his Discobolos, Polykleitos by his Doryphoros, Paionios by Grüttner's restoration of his Victory. Of the famous sculptures of the temple at Olympia there are, in the first place, Grüttner's restoration of the gables, and then casts of the Atlas metope and of several heads. A slab from the balustrade

of Nike Apteros closes the fifth century. Then follow the Hermes of Praxiteles and the Demeter of Knidos in his style, as well as the statue of Apollon Sauroctonos. Of anonymous works the best are the statue of Sophocles and the "Tireur d'Épine." The *Hellenistic* and later period (300-100 B. C.) has some of the most important pieces. Such are the Venus of Melos, the Zeus of Otricoli, the Ludovisi Hera, the Praying Boy, the Apollo Belvidere and the torso of Hercules. Of the Ephesian sculptures there are the head of Mausolus, the Hermes drum, etc. Of the friezes of the great altar at Pergamon there are some of the main slabs; the Athena group, the figures of Zeus, of Apollon, the Giant on the Steps, the Herakles and Telephos.

Christian sculpture is but scantily represented in its earlier periods—the early Christian and Byzantine—except in the collection of casts from ivories already described in the preceding *Bulletin*. For the Romanesque and Gothic periods there is a tolerably full series for France. It has been possible to give examples not only of figured but of decorative sculpture, and to illustrate the manner in which, during this period, sculpture was dependent upon architecture. This is shown by sculptures from S. Trophime at Arles, La Charité, Moissac, Toulouse, Senlis and Laon. Good examples of figured sculpture are the group of the Virgin and Child from the Porte St. Anne at Notre Dame, and two Kings from St. Antonin. From the XIII. century date the relief from the central door and the tomb of Bishop Evrard de Fouilleu, at the Cathedral of Amiens; the statue of the Virgin, a couple of reliefs and the iron-work of the main door at Notre Dame, Paris; two reliefs from the West facade of the Cathedral of Rheims; and the altar front of St. Germer. To the succeeding century belong the recumbent effigy of the Count of Artois and a statuette of

the Virgin and Child from the Abbey church of St. Denis.

To GERMANY only a few pieces belong. The group of the Prophet and Apostle from the Cathedral of Bamberg dates from the late XII. century; the statue of Queen Kuncgund from the same church belongs to the XIII. century; while the figure of John the Baptist, from the Frauenkirche in Nürnberg, is an example of the art of the XIV. century. The pieces of ITALIAN sculpture belong mostly to the Tuscan, especially the Pisan School. Of Niccola Pisano there are a couple of figures from his Pisan pulpit and a relief from his Sienese pulpit. Giovanni Pisano is represented by his group of the Virgin and Child in the Arena Chapel at Padua; Alberto Arnolli by his relief at the Bigallo; Andrea Pisano by a relief from his gate at the baptistery of Florence; Andrea Orcagna by some of the reliefs and details of his shrine at Or San Michele.

The pieces are so selected in regard to size that they can be arranged so as to fill the basement of the building as it at present stands. When this is done they will be made use of in the class work of the department.

**HISTORICAL PAPERS CONNECTED
WITH THE EARLY HISTORY
OF THE COLLEGE.**

The documents printed below are from the collection made by Mr. M. Taylor Pyne '77, and Mr. J. Bayard Henry '76, for Princeton. In our last issue this collection of papers was erroneously said to belong to the New Jersey State Historical Society.

PRESIDENT WITHERSPOON'S ARRIVAL.

Mr. Sergeant was Treasurer of the College from 1750 to 1777. He was a son-in-law of President Dickinson and a brother-in-law of President Burr. He was a member of the Provincial Congress of New Jersey from 1775—1776 and resided on

what is now called the Olden Farm at Princeton. The "Dr. Wetherspoon" alluded to is of course President John Witherspoon, the signer of the Declaration of Independence.

PRINCETOWN Sept. 15, 1768.

Sir,

Yours of the 31st of August I receivd. as to the Hoff's Affair I have receivd. only L.63 17 2 of him yet; and have the promise of more very soon: and now as I have cash in hand propose answering a Bill of L. 800 as soon as you please to draw on me & shall keep the cash ready to answer such Bill on sight.

The arivel of Doctor Wetherspoon to our College is very agreeable to its friends, and are in hopes of much good being done to its Interest by so great & good a Man as he appears to be.

I shall urge the payment of the money for the Land as soon as possible and shall immediately write to you whenever I receive it I am

Sir your most humble. Servt,
John Sergeant.

NOTICE OF THE LOTTERY TO BE HELD IN
NASSAU HALL IN 1751.

4488 Prizes

8845 Blanks

13333 Tickets at Thirty Shillings each,
is L. 19999-10

So that it is evident that there are not Two Blanks to a Prize. The Drawing is to begin on the fourth day of April next, at Nassau Hall in Princeton, or as soon before as the Lottery is filled; under the Inspection of three of the Trustees of the College. Robert Ogden, and William Pear-tree Smith, Esqrs of Elizabeth-Town; Jonathan Sergeant, Esqr.; of Maidenhead, and Mr. Ezekiel Forman, Merchant, of Princeton, are appointed Managers, and

will be under Oath for the faithful Execution of their Trust.

Tickets may be had of the several Managers; and of Theunis Day, Esq; in the County of Bergen; Dr. Samuel Tuttle, at Morris-Town; John Ogden and Nehemiah Baldwin, Esqrs, and Mr. William Camp, at Newark; Mr. Joseph Woodruff, at Elizabeth-Town; James Parker, Esq., at Woodbridge; John Johnston, Esq.; at Perth-Amboy; John Taylor, Esq., at Middletown; Mr. James Robinson, at Freehold; John Wetherill, Esq., near Cranbury; James Hide, Esq, at New Brunswick; Hendrick Fisher, Esq., near Bound-Brook; William Thomson, Esq.; and Mr. Peter Schenck, at Milstone; Richard Stockton, Esq.; and Mr. Jonathan Baldwin, at Princeton; George Reading, Esq.; at Amwell; John Hart, Esq.; at Hopewell; John Hackett, Esq., at the Union Iron Works; Samuel Tucker, Esq.; at Trenton; the Hon. John Ladd, Esq., at Gloucester; Edward Keasbey, Esq.; at Salem; William Patterson, Esq.; at Christine-Bridge; Mr. David Steuart, at Reedy-Island; Elihu Hall, Esq., at Octarara, Cecil County; and Col. Peter Bayard, at Bohemia.

THE ACCOUNTING FOR THE LOTTERY.

Among the items in the subjoined account the last one "a debt due from Benj. Franklin" is not the least interesting.

Extract from the account of
Dr. The Trustees of the College
of New Jersey in account
of Samuel Hazard.

To a Book for Records	L 1 18 0
To printing subscription papers	15 0
To printing tickets, Scheme of the Lottery, Advertst. &c.	25 0 0

To Cash paid Geo. Price for horse hire & Expenses going to Brunswick for the numbers of the tickets to put in the wheels	1 10 0
To ditto pd. for 2 Books for the Clerks,	10 0
To ditto pd. for Liquor for Ditto while the lottery was draw'g	16 6
To ditto Ditto	8 2 6
To ditto gave the Boys at drawing the Lottery when large prizes were drawn for the College	2 12 6
To Ditto paid Govr. Hamilton on acct. of the fine he &]; Secretary Peters sued the Managers of the Lottery for]	60 0 0
To Ditto paid Richard Shewell, Sheriff,	7 3
To 22 Tickets left on acct. of the College Signd. by S. Hazard,	33 0 0
98 Ditto left on acct. Ditto Signed by Wm. Patterson,	147 0 0
To Cash Lent on Interest to the Revd. Samuel Finley,	150 0 0
To Prizes paid Viz : 2 of L100 L200	
4 of 50 200	
4 of 20 80	
21 of 10 210	
167 of 2 10 417 10	1107 10 0
To a debt due from Benj. Franklin,	24 10 0
Errors Excepted,	
Philadelphia May 13th, 1751.	
Saml. Hazard.	

ORIGINAL CONTRIBUTION.

THERMAL AND ELECTRIC EFFECTS
IN THE MAGNETIC FIELD.

By G. L. SHEARER.

In Wiedemann's *Annalen* xxix-343, xxxi-737 & 760, Von Ettingshausen and Nernst described some experiments which showed a new and peculiar connection between the magnetic field and currents of electricity and heat. Two important effects were discovered which were briefly as follows. First: If a thin plate of metal carrying an electric current be placed perpendicular to the lines of force of a magnetic field a variation of temperature will occur across the plate. Second: If a metal plate traversed by a flow of heat is placed in a magnetic field an electromotive force will be set up at right angles to the direction of the flow of heat in the plate.

In many respects these results are analogous to the Hall effect. They were observed in several metals, but were especially large in bismuth, which metal also gives by far the largest Hall effect. These results had not the proper directions to be reversals of one another according to the laws of reversal of the Peltier effect. However, Prof. J. J. Thompson in discussing these discoveries, "Applications of Dynamics to Physics," p. 116, has shown that the two effects observed are not independent, but that if the produc-

tion, by a magnetic field, of an electromotive force across a flow of heat be assumed, it can be shown that the magnetic field will also give rise to variations in temperature in a plate through which an electric current is flowing.

At the suggestion and with the advice of Prof. Magie these experiments were repeated in the Physical Laboratory with a view to confirming the results and determining whether any connection could be found between them and thermo-electric and Hall effects. The results obtained by Von Ettingshausen and Nernst were completely confirmed. The electromotive force produced was found to be entirely independent of any thermo-electric action. The changes in temperature caused by the magnetic field appeared to consist almost entirely of an abstraction of heat; that is, an absorption of energy at one edge of the plate without a corresponding rise of temperature at the other. The experiment was made with two thermopiles placed opposite each other near the edges of the plate and insulated from it; when the magnetic field was set up the temperature at one of the thermopiles fell considerably, while there was a very uncertain rise, if any, at the other. This fact, which is not mentioned by Von Ettingshausen in his papers, is in accordance with the conclusion reached by Prof. Thomson from theoretical considerations.

SUMMARIES OF PAPERS
READ BEFORE SCIENTIFIC SOCIETIES.

INDUCTION AND PROBABILITY.

By HOWARD CROSBY WARREN.

In the first part of the paper the nature of Induction was considered from Mill's standpoint.

We are led to adopt the *Theory of Causation* as basis of Induction—a theory which is more explicit than the mere principle of Uniformity in Nature, but makes no assumption of correlation as required by

the doctrine of the Conservation of Energy. The Theory of Causation would furnish all the desired information if our observations were complete; *i. e.*, if every one of the actual antecedents could be observed and cases found (of each) for its presence with and absence from the same set of antecedents, as required by Mill's Method of Difference. But practically it is never in our power to make such complete observations. This gives occasion for the use of the Theory of Probability, which may be regarded as seeking to determine future effects from past observed casual relations when undetermined causes are or may be present.

The phenomena under consideration may be divided into three classes: (1) Where only a finite number of distinct results are obtained from the data, as in throwing a coin or die. (2) Where an indefinitely great variety of results are obtained, as in measuring a base-line or shooting at a target. (3) Very complex cases, such as statistics of the duration of human life, of sex, crime, etc., to the solution of which theory can only roughly approximate on account of the difficulty of reaching their causes.

Under the first type we will take the coin as the simplest case. We are about to toss an actual coin—what can we rationally say about the coming result?

(1) We cannot predict the result from the causes on account of the unknown and indeterminable elements involved. But the result is limited to two possibilities: either the head or the tail will appear. Mathematicians say that our belief is measured by exactly one-half in favor of each. But this is merely negative. It is really a case of suspended judgment. We do not mean to declare our belief that half of the throws will result in heads and half in tails, for the coin may be weighted, so that heads will appear every time.

(2) We cannot treat the subject by pure *Induction*. Having made several trials we find that the results differ—some are heads, some tails. Now the fact that with another trial their ratio will have altered shows us that that ratio is not final; and how are we to determine when the actual chances, or *separate equi-valent cases*, are exhausted? We must resort, then, to another postulate in addition to that underlying *Induction*. The principle proposed is that *all possible alternatives in kind or quantity among the undetermined causes tend to occur in a fixed, definite ratio in the long run*, if these causes are mutually independent and not susceptible of control. From this principle, which may be called the *Balance of Incidental Causes*, it follows that *dependent* incidental causes will tend towards such a ratio as well, and hence the results, also (barring the influence of factors which we can control), will tend towards a definite ratio. Now, in concrete cases (for example, with the coin), we find in experience that a definite ratio between heads and tails *is* generally tended towards, as the number of trials is increased. We are, therefore, warranted in accepting the principle in these cases, *but only because the theory is sustained by experience*.

Without *Induction* the Theory of Probability is useless. Having ascertained the ratio approximately, from a finite number of instances, we extend this ratio system by *Induction* to the general group of experiences, actual and possible. "Probable *Induction*" is induction from a group to a more general group. Unlike ordinary *Induction*, it has no direct application to the individual. Its application to the single observation is purely subjective: we may use it to measure our *belief* in regard to the next trial; and the objective warrant for this belief is shown, not by a single trial, but only by a collection of trials.

(It was then shown that the Principle

could be applied to more complicated cases of the *discrete* type and to the other types as well).

The practice of mathematical workers has been to start with a supposed fraction of "facility" or "chance" for each of the alternatives in each individual trial, the sum of the chances being unity. Then, by the Theorem of Bernoulli, the group of experienced results will, in the long run, follow these ratios. Nearly all of the mathematical work has been accomplished under this supposition. The general plan has been to reduce the problem to a question of drawing balls of various colors from a ballot-box or boxes. Underlying the solution is always the supposition that the balls are "equally likely" to be drawn. But this has no meaning when applied to a particular drawing, except to indicate our ignorance of the critical conditions; and, further, are we to accept or reject a fair-sized group of observations which do not accord with the theory? for, if we accept them, we abandon the *a priori* view for the group theory as explained above, and make that the practical test; while if we reject them as not being representative we make our ballot problem a purely ideal one, which does not correspond to the actual conditions in the original problem. *Practically*, there is no difference in the result, whether we start from the ratio of chances in a single case or the proportion of results in the long run. But the latter proceeding is the more logical one. The theory of "chances" has a meaning only if we withdraw from actual experience and suppose certain alternatives to be *contending*—an extremely anthropomorphic view.

[Abstract of a paper read before the Philosophical Club April 7, 1891.]

UNIVERSITY EXTENSION LECTURES ON CHRISTIAN ART.

By PROF. A. L. FROTHINGHAM.

The five lectures on Christian Art delivered at the Metropolitan Museum, New York and the Pratt Institute, Brooklyn, on the Saturdays from April 25th to May 23d, were intended as a comprehensive sketch of the subject, to be supplemented by the reading of a selected bibliography, as introductory to more detailed courses in this department which will be given under the same auspices next winter. This general course was less a systematic dissertation than a running commentary on the best examples of each style and branch of art, chosen so as to illustrate the varied lines of development in their similarities and contrasts during a period of fourteen hundred years. It took up the thread of the history of art where Professor Marquand laid it down in his last lecture of the same course. The titles were as follows: I. Introduction to Christian Art: II. Early Christian Art: III. Byzantine Art: IV. Romanesque Art: V. Gothic Art. In the introductory lectures especial stress was laid upon certain general facts some of which are overlooked by historians. Such are: the contrast between the technical dependence and the ideal opposition of Christian art as related to classic art, and the gradual formation of art forms that harmonize with Christian ideas. Then also, as art was gradually developed as a means of instruction it became second only to literature as a medium by which religious ideas were taught to the masses of the people. Hence in the study of the subject the ideas—their genesis, expression, growth and relation—are of even greater importance than the outward artistic form. Internal beauty takes the place of external beauty in the conception of Christian artists. The Scriptures, the

apocrypha and legends were the literary sources from which the artist drew and these were supplemented by a series of symbolic and ideal subjects conceived by the leading religious thinkers of the times. This combined corpus of subjects took two forms: an early Greco-Latin form established in the fifth and sixth centuries and originating almost entirely in the Christian East; and a mediæval Gothic form, perfected in the thirteenth century when mediæval thought found its ripest and outwardly also its most perfect expression. In treating historically of the examples of these varied art forms the following divisions were adopted. For early Christian art, the Catacombs, and Latin and western art were studied from the fourth century to Charlemagne: for Byzantine art, the early Christian oriental styles in Syria, Egypt and Asia Minor and finally the Byzantine style itself from Justinian to the crusades, to which was added an account of the broad influence of Byzantine art on the Arabs and Turks and Syria, Egypt, Spain, and even India and on western Christendom in Russia, Italy and France. The Roman-

esque period (1000—1200) was discussed almost entirely in its architecture, for it was in that branch of art that it was successfully creative, mainly through the substitution of the vault for the wooden roof in covering large spaces. This led to the æsthetic changes which varied in each province not only according to the different form of vaulting that was adopted, but owing to manifold differences in conditions and artistic temperament. Hence the multitude of schools and styles. This multiplicity was reduced to greater unity during the Gothic period through the tendencies toward social and political unification and through a greater love of general types and ideals. Art was then more harmoniously developed in all its forms and painting and sculpture not neglected for the exclusive benefit of architecture. The scholastic theory of the universe was carried out in the broad series of sculptures of the great cathedrals and in the thousands of figures in their painted glass windows. This most perfect union of art and religion was swept away in the XV century by the rising tide of the Renaissance.

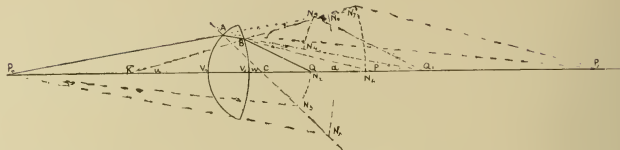
SPHERICAL ABERRATION.

By GEORGE MACLOSIE.

Preliminary Abstract.

The problem of Spherical Aberration is usually dismissed on account of its alleged complexity, and approximations are substituted which suffice for the narrow aperture of telescopes, but are unavailable for the microscope. The complete problem, however, admits of an easy geometrical solution, and can be managed analytically by a few not very difficult stages. This

kind of aberration depends on the fact that rays passing near the margin of a refracting surface or lens of spherical curvature meet again sooner (in case of convex lenses) than the rays which traverse the thicker or central part of the lens (and conversely as to concave lenses). The difference between the focus for central and that for lateral rays is the aberration which may be measured *longitudinally* (along the main axis), or *laterally* (on a transverse plane). In this paper it is measured longitudinally.



Explanation of Symbols. In the figure, $V_0 A B V_1$ represents a lens, of t thickness (from V_0 to V_1 , the two vertices), of n refractive index (nearly $1\frac{1}{2}$ for common glass); C is the centre of curvature, and $r = A C$ is the radius for the front surface; K is the centre of curvature of the second surface, and $s = K B$ its radius. A luminous point P_0 is c_0 distant from the centre C ; $P_0 A$ is a marginal ray from this point incident at a point A whence the radius $A C$ makes an angle w with the main axis.

We have to find $A Q_1$, the course of the refracted ray whose direction cuts the axis at Q_1 , distant c_1 from the centre C ; the angle u , which the radius $K B$ to the point of emergence B makes with the axis; the ray $B Q$, where after the second refraction $A B$ cuts the axis at Q , k distant from the centre K ; also the conjugate foci, P_1, P , for 'central' rays (passing near the vertex V_0) after the first and second refraction respectively; P_1 being distant p_1 , from centre C , P being distant p from the centre K ; and finally the aberration $a_1 = c_1 - p_1$ for the first surface refractions, and $a = k - p$ for the aberration of the whole lens.

I. Geometrical Solution.

Produce $P_0 A$ to N_0 , so that $P_0 N_0 = n$ times $P_0 A$. Next with centre P_0 draw the arc $N_0 N_1$, cutting the radius $A C$ produced in N_1 . Join $P_0 N_1$. Thus the triangle $P_0 A N_1$ has one of its sides n times the other, and the sines of its angles in the same ratio. Next from A draw parallel

to $P_0 N_1$, the straight line $A Q_1$, cutting the axis in Q_1 , which is thus determined. The angle $N_1 A Q_1$ being equal to the angle at N_1 , is consequently one- n^{th} of the angle $P_0 A C$, so agreeing with Snell's law of refraction.

To find the point P_1 for central rays, suppose $P_0 A$ to coincide with $P_0 V_0$, then N_0 will lie at N_1 , and we require a point P_1 such that $N_2 C : C V_0 = P_0 C : C P_1$. This can be found by drawing with centre C , the arc $N_2 N_3$, then joining $P_0 N_3$, and from A drawing parallel to $P_0 N_3$ the line $A P_1$, cutting the axis in P_1 the required point.

For the *second refraction*, from the line $Q_1 B$, cut off a part $Q_1 N_4$, one n^{th} the distance $Q_1 B$. Next with centre Q_1 draw the arc $N_4 N_5$, cutting the radius $K B$ produced in N_5 . Join $N_5 Q_1$, and from B draw $B Q$ parallel to $N_5 Q_1$, cutting the axis at Q , which will be the aberration-conjugate focus of P_0 for the whole lens, as to rays at radius-angle w . For the central rays, cut off from $P_1 V_1$, a part $P_1 N_6$, one n^{th} the line $P_1 V_1$; from centre K draw the arc $N_6 N_7$, cutting the produced radius $K B$ in N_7 . Join $N_7 P_1$, and from B draw $B P$ parallel to $N_7 P_1$, thus determining the point P , whose distance from K is p . The distance $Q - P$, or $k - p$ is the aberration for the whole lens, (negative in case of a convex lens).

II. Analytical Method.

1. In the triangles $P_0 A C, C A Q_1$, where the angle $P_0 A C = n$ times the angle $C A Q_1$, we can obtain the conjugate focal distance c_1 , in terms of the distance of the luminous

point, c_0 , of the radius r , of the included angle w , and of the refractive index n . This gives $c_1 =$

(1)

$$\frac{c_0 r}{\sqrt{n^2(c_0^2 + r^2 - 2c_0 r \cos w) - c_0^2 \sin^2 w} - c_0 \cos w}$$

2. For parallel rays, where the distance c_0 is infinite, the formula becomes

$$c_1 = \frac{r}{\sqrt{n^2 - \sin^2 w} - \cos w} \quad (2)$$

3. For a flat-faced lens, in which the radius r is infinite, we obtain a formula either directly, or by reduction from (1) assuming v_0, v_1 , as the vertex distances of Q_1 from the vertices V_0, V_1 , respectively,

$$\cos u = \frac{r^2 \sin^2 w k_1 \pm (c_1 + r \cos w) \sqrt{s^2 (c_1^2 + r^2 + 2c_1 r \cos w) - r^2 \sin^2 w k_1^2}}{s(c_1^2 + r^2 + 2c_1 r \cos w)} \quad (5)$$

(Take the upper sign for a convex lens).

Here $k_1 = c_1 + r + s - t$.

(6) To find the distance k (from K to Q) we proceed as by formula (1), sub-

$$k = \frac{k_1 s}{k_1 \cos u - \sqrt{\frac{1}{n^2} (k_1^2 + s^2 - 2k_1 s \cos u) - k_1^2 \sin^2 u}} \quad (6)$$

(7) In the same way we can obtain from formula (4) for central rays the distance (p) of the point P from K. This is

$$p = \frac{p's}{k - \frac{1}{n}(p' - s)}$$

where $p' = p_1 + r + s - t$. Hence the aberration, for the first surface refractions

$$a_1 = c_1 - p_1;$$

for the lens (including both first and second refractions)

$$a = k - p.$$

It will be observed from the figure that the aberration for the whole convex lens is much less than for the first surface. In a case which we worked out, the radii were assumed as 10 and $22\frac{1}{2}$ millimetres, the angle $w = 45^\circ$ the distance $c_0 = 37\frac{1}{2}$, and $n = 1.5$; and the results were nearly 28 for the aberration for the first surface, and about 10 for the aberration of the lens.

and $d =$ distance A V_0 , we obtain the formula

$$v_1 = \sqrt{n^2 v_0^2 + (n^2 - 1)d^2} \quad (3)$$

4. For central rays we obtain the distance p_1 (of P_1 from C) by making the angle w in formula (1) = 0. Hence,

$$p_1 = \frac{c_0 r}{n(c_0 - r) - c_0} \quad (4)$$

5. We find angle u by determining the point of intersection B, where the direction of the ray A Q_1 , after the first refraction, meets the curve $V_1 B$. Assuming k_1 as the distance of Q_1 from K, and s as the radius KB, this gives

stituting $\frac{1}{n}$ for n (as the ray is emergent),

and changing the signs because of the change of convexity of the curve. Thus

To find the laws of increase and decrease of the aberration and the best forms of lenses we must use the differentials of the above formulæ; a subject requiring separate treatment and involving intricate formulæ.

Having found the aberration for a lens, we can proceed from its last refraction to the refraction of the first surface of the succeeding lens of a system, by the same method given above for proceeding from the first to the second surface of a single lens. Thus step by step any number of successive refractions may be measured; though it would be a complex formula that would combine them all in a single equation.

[Reported to the Princeton Science Club, April 10, 1891.]

ON THE MODE OF EVOLUTION IN THE
MAMMALIA.

By W. B. SCOTT.

The question, as to the single or multiple origin of genera is perhaps rather about words than things, and will depend to a great extent upon the view taken with regard to the definition given of the word genus. If we make classification a strict expression of real relationship and not of mere similarity of structure, as should certainly be the end proposed, then it is obvious that all the species of a genus must be more nearly allied to each other than to any other species recent or extinct and therefore that genera are necessarily of single origin. But as genera are at present employed and in the present state of knowledge such an exact expression of relationship is impracticable, as that would necessitate a minute knowledge of the phylogeny of each species, such as we are very far from possessing. In the current usage a genus is a group of nearly allied species agreeing among themselves and differing from all others in the possession of some common character. But if the various species of an ancestral genus may acquire the new character independently of each other (parallelism), or if the species of widely different genera may gradually assume a common likeness (convergence), then it is plain that such a genus is an artificial assemblage of forms of polyphyletic origin. That such parallelism of development does occur, we shall see in the next section, and there are good reasons for believing that convergence is not so rare as it is generally assumed to be, and that therefore many generic groups are more artificial than real. While it is easy to make these distinctions theoretically, in practice it is a matter of extreme difficulty even under the most favourable circumstances, at least so far as the cases

of parallel development are concerned, for the known cases of convergence show that this process is more apparent than real, and may generally be unmasked on careful examination. But the relationship of the various species of two successive genera is generally very obscure. In a given case, each of the five species of genus A, may seem to be derived from a different species of genus B, and yet such an assumption may be altogether erroneous, because of the tendency so frequently observed for each member of a descending series to develop a similar cycle of variations. This is very generally observable in well preserved series of fossils extending through several formations. Nevertheless the facts of palæontology render it extremely probable that many genera, *as now constructed*, are of multiple origin, a view long ago adopted by Cope, but our present knowledge is insufficient to enable us to point out the particular cases.

The problems of parallelism and convergence open up a discussion of far reaching extent and importance, which can only be briefly touched upon here, though the facts of palæontology are perhaps the most instructive in this connection. What we may call negative parallel development, *i. e.*, the independent suppression of similar parts in different phyletic series, is a very well recognized phenomenon. Thus nearly all known Puerco mammals agree in having the entepicondylar foramen of the humerus, the third trochanter on the femur, a perforated astragalus, an alisphenoid canal and probably interlocking cylindrical zygapophyses on the posterior dorsal and lumbar vertebræ. In existing groups these characters are scattered and combined in the most heterogeneous fashion, suppression or retention of one or other of them being carried out in the most widely separated groups of mammals. In the same way reduction in the

number of digits, of teeth, of vertebræ and ribs, may likewise be carried out in very different groups. When we come to examine positive differentiation the same thing is found to be true. The prismatic cement covered molar has been independently developed in many forms, ruminants, certain pigs, the horses, one rhinoceros (*Elasmotherium*) the elephants, many rodents, &c. This also applies to the scalpriform incisor which is repeated in many different orders of mammals. Within narrower limits, the selenodont molar has been several times independently evolved. 1) in the true ruminants, 2) in the oreodonts, 3) in the camels, not to mention the somewhat aberrant types of dentition exhibited by *Anoplotherium*, *Xiphodon*, *Cainotherium*, &c. The spout-like odontoid process of the axis has arisen in the true ruminants, the horses, the camels, and to a certain degree in the Oreodonts. The proximal end of the humerus in the modern Tylopoda is extremely like that of the horse, and the lower Miocene representations of those two series, *Pæbrotherium* and *Meshippus*, also agree exactly in the structure of the humerus, but in this case it is of the more primitive type with single bicipital groove and no bicipital tubercle. The steps of modernization in many very different groups keep curiously parallel, as may be seen for example in the series of skulls figured by Kowalevsky, where we find similar changes occurring in such groups as the pigs, deer, antelopes, elephants, &c. Of similar import are the simultaneous and similar variations of many different groups according to geographical location, such as the characters of the Lepidoptera in the different Malay islands, to which Wallace has directed attention, and which is exemplified in such a striking way by the colouring of Arctic and desert animals and very many other well known phenomena. These facts mere-

ly emphasize the conclusion long since universally accepted, that no natural system of classification can be founded upon a single character. But parallelism may extend much further than this and embrace not single characters only, but whole series of them, and it is this fact which renders the proper reference of such forms as *Leptomeryx* so very difficult. If the interpretation of cameline phylogeny be correct, then the Pecora and the Tylopoda have no common ancestor nearer than the *Dichobunidae*, animals with quinquetuberculate upper molars, complete dentition, short limbs, and tetradactyle feet. The two series have independently acquired tetraselenodont molars, have lost all or nearly all of the superior incisors, have developed types of skull which with all their differences have many features in common; in both, the limbs have been greatly elongated and especially the metapodials, ulna and fibula are very much reduced and in precisely the same fashion; the cannon bones in both series are composed of just the same elements; in both epispheal processes have been independently developed on the lumbar zygapophyses, as well as the spout-like odontoid process of the axis. The stomach of the camel resembles that of the typical ruminants in a way that we cannot suppose to be due to a common inheritance from the *Dichobunidae*. In both series the final result is strikingly alike, though the parallelism is by no means complete, and as we have already seen, the keen insight of Rüttimeyer detected the true relationship from a comparison of the modern forms alone. In one respect, however, my interpretation of the facts differs slightly from his. Rüttimeyer regards the llama as less aberrant than the camel; a better statement would perhaps be that its parallelism to the Pecora is more complete. *Leptomeryx* also is a conspicuous example of the same truth;

its resemblance to the tragulines is very striking, and yet it is very doubtful whether it is at all closely related to them, and in many respects this genus is much more differentiated than any known traguline, recent or extinct. It is not at all improbable that its traguline features are due rather to a convergence of development, conditioned by the very small stature of the animal. A similar statement would apply to *Cainotherium*. The resemblance between the creodonts and the carnivorous marsupials has been much dwelt upon, but I think it can be shown that the relationship between the groups is a very remote one and that the points of likeness are due partly to parallel development and partly to a retention of primitive characteristics. The group of reptiles present very similar phenomena. On the one hand we have the Dinosauria which have developed so many ornithic peculiarities in the hind limb, while the Pterosauria possess equally striking avian features in the skull, vertebrae and shoulder girdle. To assume, as has been done, that the birds are diphyletic, is to admit the principle of convergence in almost its extreme form, while if this be denied, then the avian structures of either the Pterosauria or Dinosauria, or both, must be due to parallelism.

Similar conclusions drawn from a very wide range of animal groups might be easily multiplied, but those here given are sufficient to prove what probably few morphologists doubt, viz., that parallelism and convergence are very real phenomena. Much more difficult is the attempt to decide how far these processes may be carried. In all of the cases cited the final result is similarity, not identity and there is always some fundamental discrepancy which exposes the deceptive character of the process. We have already quoted Rüttimeyer's opinion as to the relationship

between the camels and the true ruminants, and others might be cited to show that a sufficiently careful use of the comparative method is often able to avoid these obstacles. But in the construction of the larger taxonomic groups, which embrace so many and such various forms the difficulties arising from parallelism, both positive and negative, and convergence become greatly increased and only complete and unbroken phyletic series will enable us to overcome them entirely. Nevertheless, the comparative method will very frequently avoid the difficulty, if carried out on the lines laid down by Fürbringer of *neglecting nothing*, of using sufficiently abundant material and every possible auxiliary. These considerations render it apparent that Huxley's dictum to the effect that in forming natural groups, "it is more important that similarities should not be neglected, than that differences should be overlooked," cannot be maintained; on the contrary it is only a due consideration of the differences that enables us to distinguish artificial from natural groups. It is likewise true that no rules can be laid down for determining the taxonomic value of any particular structure, whether it is adaptive, inherited, positive or negative. In this particular every group must be considered by itself, "neglecting nothing."

Paleontology is not well adapted to solve the problem as to whether lost structures may be regained, because we can never be sure that any case which might seem to require such an interpretation is not rather due to an imperfection of the record. For example, the apparent reacquisition of a digit or tooth might really be due to the fact that the ancestors of the polydactyl form had not been preserved. There are, however, some facts that seem to indicate that such reacquisition may occasionally take place. All of the wild members of the existing *Canidae*

have but four digits in the hind foot, and so far as is known at present this is also true of all forms later than the upper Miocene; yet in certain domestic breeds the hallux is present and appears to have been redeveloped. In many forms with reduced digits, such digits frequently reappear in individuals by reversion, and if under changed conditions such reversions should prove advantageous, there seems to be no *à priori* reason why they should not be selected. If Weissman's interpretation of the relations of Siredon to Amblystoma be correct, we have here a clear case of a lost organ being reacquired; *e. g.*, the gills: though in this case the gills are normally present and functional in the larval state of Amblystoma. At all events such reacquisition among the higher animals, at least, would certainly seem to be unusual, and should not be assumed in any given case except upon the clearest evidence.

So far as the series of fossil mammals which we have been considering are concerned, the developmental history appears to be very direct and subject to little fluctuation, advancing steadily in a definite direction, though with certain deviations. Thus in the cameline series the size and position of the orbit, the shape and character of the posterior nares, appear to change first in one direction and then in another, so that in some respects the skull of *Poebrotherium* is more modernized and ruminant-like than that of the camel. But these fluctuations are slight and of no great importance. On the whole we are impressed by the steady progress of differentiation; thus in the equine series the premolars one by one become molariform, the molar pattern more complex, the face elongated, the digits are continually reduced in number, the limbs become more and more elongated, the median digit more and more enlarged, and the stature

of the whole animal increasing. In many genera the cycle of variation appears to be a singularly small one; and, as Neumayr has observed in the mollusca, the same or a very similar cycle appears in successive genera. Thus in the genera *Palæosyops*, *Diplacodon* and *Titanotherium*, of the Bridger, Uinta and White River formations respectively there are curious similarities in the specific variations of the three. Indeed, the limited plasticity of mammals, except along certain definite lines, is very marked. In every formation the majority of species appears to die out without leaving successors, and too early a specialization in any particular, would seem to be fatal to the perpetuation of a group. With rare exceptions, the progenitors of permanent lines seem to be those forms which have not strayed too far from the safe middle course; and every formation contains numerous examples of what from one point of view may be called premature differentiations, advantageous to their possessors, but not sufficiently plastic to adapt themselves readily to new conditions. These facts are opposed to the assumption that in the evolution of a mammalian phylum frequent alternation of advance and retrogression occur. Of course, a mammal may advance to a certain degree and then degenerate, but that is not the point under consideration. Obviously this conclusion is far from certain, and may well be modified or even disproved by more extensive and complete material. Nor can we extend this result to the lower groups. The facts which have been brought out with regard to the Axolotl, and the experiments of Schmankewitz on *Artemisia*, render it inapplicable to these forms.

As a general rule it certainly appears to be the case that among mammals differentiation is by reduction in the number of parts, but there are some facts which

go to show that this rule is not without exception. Thus the toothed whales have certainly increased the number of teeth and of phalanges in the paddles; and in certain breeds of dogs a double hallux has been rendered constant. The fourth molar of *Otocyon* appears to me more probably either a case of this sort, or of a permanent reacquisition, as any other assumption with regard to it seems much more unlikely. (a) That all the fossil cynoids have nothing to do with existing dogs can hardly be believed by any one who has examined the material, and yet all of these, with occasional individual exceptions, have but three molars at most. (b) That the *Canidae* are of dual origin, one line through *Miacis*, *Daphænus*, *Cynodictis*, etc., to *Canis*, and the other through unknown ancestors to *Otocyon*, involves a degree of convergence which known facts would not justify us in assuming. Between the third and fourth hypotheses that the additional molar is atavistic, or that it has been added *de novo*, it is very difficult to decide, for in the fairly complete mammalian series, which we have considered, neither process can be shown to have taken place. Yet both are conceivable, and do occur in individual cases, and if so, there seems to be no reason why under favourable circumstances, and provided they recurred frequently enough, they might not be selected and perpetuated. In *Otocyon* the dentition is much more primitive (aside from the number of teeth) than in any other known member of the family recent or fossil, and judging from the stage of development of the skull and skeleton, this condition almost certainly implies retrogression, which may have stimulated atavistic tendencies. However, the problem can be solved only by a much more complete phyletic series than we can at present command. At all events, this reacquisition or addition *de novo* can only

be very exceptional in the history of the higher mammals, the histories of those which we know fairly well exhibiting nothing of the kind.

In large groups of mammals the mode of reduction of parts is generally a very uniform one. Thus Owen's law of the reduction of digits holds good for all known ungulates. Great uniformity is also exhibited in the order of disappearance of the teeth, but this is not without exception; *e. g.*, in *Artiodactyles* generally the first premolar is usually the first one to disappear; but in the camel this tooth is retained, while the second is lost. The *Creodonta* and *Carnivora* follow another law, but here there is less uniformity, and other exceptions might be cited. With regard to the mode of reduction of the vertebral column fossils are not well adapted to throw light upon the question, because it is very rarely that specimens are found in which the vertebral column is at all complete. So far as the evidence goes, however, it appears to favour Fürbringer's position, that reduction is from behind forward, and that the changing numbers of the dorso-lumbar vertebræ are due to a shifting of the limb girdles. The early forms in which the number of the trunk vertebræ is known have for the most part a greater number than their modern representatives, and a very general characteristic of the early mammals is their very long, stout and well developed tails. This evidence is, however, too imperfect to be at all conclusive; and whatever may be true of mammals, Parker's results seem to show that in the turtle, suppression of the vertebræ may take place in the cervical region without affecting the position of the shoulder girdle or the number of dorso-lumbar-sacra.

Increase of size and weight of body of course entails increased thickness and massiveness of the bones, with much more

prominent and rugose processes for muscular and ligamentous attachments; but the effect upon the skeleton is much more far reaching than this, as will appear from a comparison of the Proboscidea, the Dinocerata and the gigantic perissodactyl, Titanotherium, which are about as widely separated as three ungulate lines can well be. Little is known about the phylogeny of the elephants, but so far as the other two series are concerned, their earlier members are in many respects less alike than the later ones. In the final members of these three lines we find many and striking resemblances. The neck is shortened, the trunk very long and the anterior dorsal vertebrae rendered very heavy, with much elongated spines to support the massive head. The ribs are very long and strongly arched to carry the enormous mass of viscera. The scapula is triangular in shape and in the Dinocerata extremely like that of the elephant, with greatly elongated suprascapular border and very large postscapular fossa, prominent and massive acromion and distinct metacromion. The humerus is much alike in these two groups, but that of Titanotherium is more rhinoceros-like. In all, the ulna is unreduced or even enlarged; the carpus is composed of massive cubical blocks. The ilium is in all greatly everted and immensely broadened in the transverse direction. The femur is long and massive, that of Uintatherium is almost an exact copy of that of the elephant, having neither third trochanter nor pit for the round ligament, both of which are preserved in the earlier members of the Amblypoda, *e. g.* Coryphodon. In all the tibia is short and the fibula complete; the astragalus extends far over on the cuboid (*e. g.* in the elephant separated from it by the extension of the navicular) and is little or not at all grooved so that the maximum of motion is at the knee-joint. The tarsus of Uintatherium

is extremely like that of the elephant in general character, while that of Titanotherium does not lose its perissodactyl structure. The metapodials are short and massive especially so in the Dinocerata and Proboscidea, and the ungual phalanges reduced and nodular in shape, showing that in all the foot was enveloped in pad. It seems probable that great size of body inhibits very generally the reduction of digits. In Titanotherium the number is, it is true, IV—III, but then this degree of reduction is already reached in the Bridger genus *Palaeosyops* which is of moderate size. The other two series are pentadactyl.

In all three series there are no medullary cavities in the long bones, the interior of which is filled with cancellous tissue. The comparison might be extended to the larger rhinoceroses and hippopotamuses and would show much the same state of things in a less pronounced degree. It is thus apparent that mere increase in size and body-weight may produce many remarkable convergences in skeletal structure in animals which are but distantly related. Indeed so many and great are the approximations of the Dinocerata to the elephants, that Cope at one time proposed to incorporate them in the Proboscidea. The materials for determining the effects of great diminution in size among the ungulates are much less complete and satisfactory, though probably the many points of resemblance between the tragulines, *Leptomeryx*, and *Cainotherium* are largely due to this factor.

The conclusions as to the mode of evolution which thus seem to follow from the study of series of fossil mammals can make no pretensions to novelty, as they have all been repeatedly suggested before. Nor can they be regarded as entirely conclusive, for some of them, as we have already seen, may be interpreted in several ways, nor is

it possible to entirely avoid all presuppositions in the very construction of phyletic series. Nevertheless, inasmuch as there is so little agreement on these points, I have thought that it would be of service to clearly state just what the problems are and how the facts seem to solve them. On some of the questions the evidence speaks in no uncertain fashion; thus for example, arrange the phyletic series how we may, the occurrence of parallelism and convergence in development is clear. This conclusion can only be avoided by the assumption of complex cross and reticulated relationships, such as no one has ever ventured explicitly to defend. I venture to hope that morphologists may test and extend these tentative results by applying to them other and wider classes of facts than those from which they have been drawn.

[Abstract of a paper read before the Princeton Biological Club, May 21, 1891.]

AN INQUIRY INTO THE EFFICIENCY OF SOME OF THE STRUCTURAL FORMS IN IRON AND STEEL STRUCTURES.

By CHARLES McMILLAN.

The employment of angle-irons in riveted structures renders an inquiry desirable into their efficiency when fastened, as they usually are, by one leg only. The effect of an eccentric stress upon a body is equivalent to the application of an equal stress in the line passing through the centre of gravity, together with a couple whose moment is the product of the given stress into its perpendicular distance from the centre of gravity.

Accordingly, an angle-iron fastened by one leg only, and therefore receiving stresses eccentrically, is necessarily subject simultaneously to two distinct effects:—direct compression or tension, as the case

may be, and a bending moment. The joint effect upon the outermost fibre of an angle-bar thus fastened is, within elastic limits,

$$\pm \left[p + \frac{M d}{I} \right]$$

where p =intensity of stress due to direct action,

M =bending moment due to eccentricity of stress,

d =distance from centre of gravity to outermost fibre,

I =moment of inertia of the cross section.

The expression has been written for the fibre in which the direct and bending stresses conspire to produce the same kind of effect.

Were there no tendency to produce bending in the piece, the uniform intensity at all parts of a given section would be simply p .

It is therefore obvious that an angle-bar fastened by one leg cannot develop its full strength without the aid of auxiliary external forces or of counter moments, and that if no such modifying causes exist, there is but one way to develop the full strength of the bar, viz., to fasten it by both legs. It is only in connection with this latter mode of fastening of angle-irons that the principle that intersecting lines of stress should meet at a common point finds a satisfactory application. Its violation in riveted work has been almost the rule, sometimes in order to make way for convenience in fitting, sometimes through mistakes as to the actual lines of stress, and not infrequently, it is believed, through ignorance or heedlessness as to the effects of its violation. Singularly enough, instances exist where the web members, more particularly, of a structure are, through the violation of the principle, stronger than if it had been adhered to. This is because, in such cases, a bending moment is developed in a joint

in opposition to the bending-moments induced in the pieces which meet to form that joint by their eccentric fastenings. On the other hand, both kinds of moments often conspire to weaken the numbers.

It has been suggested that the theory herein propounded is defective because a bending test of riveted floor-beams by Mr. Strobel, carried to destruction, developed the full strength of the flanges (from 50,000 lbs. to 53,000 lbs. per square inch) notwithstanding the fact that the angle-irons of which the flanges were composed were each fastened to the web by but one leg (the proper construction.) The reply is that the criticism is itself defective in that it does not take into account all the forces to which those angles were subjected. It must be remembered that just before the instant of rupture the beams must have been deflected downward to a considerable degree. That such deflection, by virtue of the bending alone, must have tended to cause an extension in the lower part of each upper flange-angle and a corresponding compression in the upper part of the bottom flange, and that these tendencies must have acted in opposition to what are known as the flange-stresses. The test can be followed analytically only

to the elastic limit, at which limit it would seem that there was a tendency, due to bending alone, to compress the uppermost fibre of the bottom flange with a stress of from 12,000 to 15,000 lbs. per sq. inch. This necessarily must have relieved the riveted leg of some of the tension induced in it by the rivets and to the same extent increased the burden in tension on the free leg of the angle. The general tendency of the two simultaneous actions, as the test was carried towards destruction, was undoubtedly towards an equalization of the resultant stresses in the two legs.

The numerical value here given of the stress caused by bending alone, cannot be depended upon as correct, for the reason that the proper value of the coefficient of elasticity in riveted beams has not been sufficiently well established by experiment. Such experiments as have been analyzed seem to indicate that its general value is not much more than one-half of the coefficient for solid beams.

When all the conditions of the test are considered, the results confirm instead of contradicting the theory advanced in this paper.

[Abstract of paper read before the Princeton Science Club, April 9, 1891.]

SUMMARIES OF PAPERS PUBLISHED.

CHRISTIANITY AND TOLERANCE.

By W. M. SLOANE.

After a discussion of the various forms of relation between Church and State in Europe, that of the United States is examined. A free Church in a free State implies a religion in whatever form and a government. Among antagonistic religions there must be some prevailing form. We have hitherto had laws protecting the

family, Sunday laws and religion in the schools and other public institutions. Chaplains have been appointed by the Government, and judges have decided that Christianity is the law of the land. All these positions are now attacked. Two views honestly held prevail—one that the Federal Constitution and Government are infidel and ought to be made Christian; the other that they are already Christian and should be kept so. Thus the question arises, whether in a land where Jews, in-

fidels, heretics and Christians are all equal before the law, Christianity is to tolerate or be tolerated?

Assuming, then, that we have a free Church in a free State, and mean to stand by the system, the question of what Christianity may tolerate to that end becomes the all-important one, for here at once presents itself the popular and specious phrase—the rights of man. Nothing is more admirable, as nothing is more intractable, than the individual conscience, when there is one. How shall we deal with it? Within the sphere of thought, and even the free expression of thought, the State will not meddle. Christian censorship is after all human, and subject to human blindness. The safest side seems, on the whole, to be that of abstention, though it is difficult enough to maintain composure among the ravings of anarchists, or in hearing the smooth phrases of false moralists. But, on the whole, common sense and a noble self restraint demand a retort in kind. The press and the platform should be as loaded with argument, with literature, with speech, with agitation from the Christian side as it is from the other. Until the hour for action arrives the tongue and the pen should be active in season and out of season. The tendency to degenerate in all human things has become the trite theme of the moralist. It can only be met by the constant struggle for the existence of the right, which is the law of the moral universe. We use certain phrases until their sound becomes wearisome—one of these is “public opinion.” Let us beware of such an insidious temptation. Such phrases are like the folk-song in music—they give an insight into national character, and so afford help in the statement of problems. We must ever study and interpret them, and give them new meaning as every new day creates a new phase of the situation. Public opinion

is the first and last peaceful resort. Until every effort has been put forth in shaping it and leading it, resort to other means is criminal.

But when fanatics and aliens attempt to act what they teach, the case is far different. Are we, in a misbegotten zeal for the rights of men, to have regard only to the rights of other men? If we are simply tolerated in our own home and the land of our birth, if the subjugation of the wilderness, the struggle for civil and religious liberty fought by our ancestors, the patient efforts in framing our institutions, the wisdom in interpreting them, the self-devotion of martyrdom, in dying for them—if all these give us no prior claim, and are to sink into oblivion—even then we have at least equal rights with the last arrival, the overheated agitator whom the traditions of social tyranny have imbued with a hatred of all order, or the pious and earnest devotee who preaches a return to mediævalism. And, besides, we have the responsibility of numbers and of force. How are we to use it—to choke our own convictions, to hamper the public action which alone makes right living possible, to abdicate in short, and, from false sentimentality, commit the greatest crime possible to be conceived! There is a certain sense of shame in the utterance of such language even by the way of rhetorical trope. Nowhere else than here could the words have a serious meaning. Some signs, however, there are that such is the case. When a noisy clamor was made in 1876 demanding the opening of the great exhibition on Sunday, the dignified and sufficient answer made by General now Senator, Hawley, was, “It is not the American way.” Ask yourself whether such words fall to-day with the same force on the public ear? For many, many years the practice, once almost universal, of introducing the name of Christ into Thanks-

giving proclamations has been abandoned. The exclusion of the Bible from any of our public schools would at onetime have been unthinkable. And could anything on the face of it be more preposterous than the demand successfully made that all history should be banished from public institutions, except that which gives a garbled and incomplete account of the very Reformation which called us into existence?

Suppose these are mere straws. Can we make a similar catalogue of some which point the other way? Unfortunately not. Referring again to the uses of a theory—here is an admirable illustration. If the American State belong to the lowest forms of organism, and be but an aggregate of local units, as certain growths are simply a mass of spores, we may look on with concern, but we cannot help ourselves. If, however, it be a higher organism, where the parts interact upon each other, and life results from the constant and harmonious interchange of relations, we dare not stand by in idleness, and it becomes the duty of the authority which expresses the ultimate popular will to intervene for the prevention of moral disease and contamination. It must be repeated again and again, Christianity is not tolerated in the United States, it tolerates; and it tolerates, and can tolerate, no public action which endangers its existence and threatens the institutions under which it lives most perfectly.

There is much ado in our time about the scholar in politics. This is a plea for the Christian scholar in politics. Much of the criticism, not to say scorn, which has been heaped on the scholar is fully deserved; much is, of course, captious and idle. The one truth in the whole accusation is in the charge of feebleness, and it is to be feared that the same accusation would lie at the door of the latter class. There is an element in intellectual training

which is very dangerous. From the first the child is compelled to accept much which he does not understand; at a later stage his mind is carried through a long course of mechanical exercises to secure accuracy and pliability. Then in university work, if it be the right kind, the mind is awakened to the necessity of seeing both sides before coming to a conclusion, and so wide is the field and so much time is spent in the scrutiny of both views, or many views, that the power of drawing inferences, establishing positions, and proceeding to action is very nearly destroyed. What we want in the Christian scholar in politics, is not less investigation, but more; but we also want decision and courage in thinking, decision and courage in acting. The indifferent and hostile do not hold aloof; they are in the thick of the conflict—learning, planning, insinuating, acting. There was a mediæval topic of debate among the schoolmen as to whether God or the devil were more powerful. The theme is not entirely antiquated. Their conclusion was a compromise, explaining that God was undoubtedly the more powerful, but that the devil made up for it by his pernicious activity. Progressive heterodoxy in politics has not the power of right, but it has the power of wide information and the advantage of a great activity. Energy alone can give the right to tolerate and remove us from the position of being tolerated.

[April (1891) number of the *Presbyterian and Reformed Review*.]

THE STUDY OF OCEAN TEMPERATURES AND CURRENTS.

By WILLIAM LIBBEY, JR.

The ancient cartographers represented the earth as encircled by an ever flowing ocean. This may indicate some knowledge on their part of the oceanic currents. The first record of such a current is found

in the account of a voyage of Ponce de Leon, whose ships met a current off the Florida coast which carried them backward against a fair wind.

This current of the Gulf Stream was studied by Franklin and others. It has been proved that it does not arise in the Gulf of Mexico, but is a continuation of the Equatorial current that starts off the west coast of Africa and crosses the ocean to the Windward Islands. Off the Florida coast its velocity is from 3 to 5 miles an hour, greater than that of the Mississippi between the Ohio and the Arkansas, and its breadth is 30 miles. As it moves northward its velocity decreases and it widens out, until off Nantucket its velocity is from 1 to 2 miles an hour and its width 300 miles. At the same time it breaks up into several bands on its eastern side. On the Western side the cold Labrador current keeps its edge more definite; in one instance observed by Professor Libbey, the meeting of the warm water flowing northeast with the cold water flowing southwest was so sharply defined as to produce a disturbance similar to those known as tide rips.

The cause of these ocean currents is probably the friction of the trade winds, with the variations of density caused by heat as a secondary or modifying factor. The orbit like course of the currents is due to the influence of the earth's rotation.

The study of the Gulf Stream instituted by the author for the United States Fish Commission, was undertaken to obtain data which might be useful in studying the migrations of the mackerel and other food fishes. It consisted in the study of ocean temperatures at various depths in the waters lying south of Nantucket and Martha's Vineyard. In the first year, in which the Fish Commission Schooner *Grampus* was used, there were 136 soundings made at as many stations, and 1600 water temperature observations were made, besides meteorological observations. These observations showed that the position of the Stream was influenced by the prevailing winds. The warm water was broken up into bands and carried over on to the cold current travelling in the opposite direction. In the second year the Coast Survey Steamer *Blake* was used in addition to the *Grampus*. Soundings were made at 375 stations, giving 4000 temperature observations, and 1000 specific gravity observations. A party of observers was stationed on the New South Shoal lightship, off Nantucket, who obtained records of meteorological conditions for comparison with the records made on the vessels, and also observed the tidal movements and the directions and velocity of the currents.

[Abstract of a lecture delivered at Woods Hole, Mass., and published in "Biological Lectures, 1890,"]

REVIEWS OF BOOKS.

AMERICAN RELIGIOUS LEADERS. FRANCIS WAYLAND. By James O. Murray, Dean and Professor of English Literature in Princeton College. Houghton, Mifflin & Co., Cambridge, 1891.

The publishers are to be congratulated on securing Dr. Murray as the biographer of Dr. Wayland. He has exceptional qualifications for the task assigned him. A pupil of Dr. Wayland, a Christian minis-

ter, an interested observer of public affairs, an experienced educator, and a master of expression, he has been able to enter with sympathetic interest into the study of all the phases of Dr. Wayland's career, and has given us an interpretation of them in a volume which is not only a record of the past, but also an expression of opinion upon questions of current discussion.

In these days of specialism, when the man of general information is so commonly disparaged, it is interesting, and it would profit some, to read the life of a representative man like Dr. Wayland, and learn through his example that there is also a place and a large one for the man who has the power of doing respectable work in several directions. Dr. Wayland was certainly a representative man: the publishers of this volume have made no mistake in including him among the "leaders of religious thought" in America. Yet this position is not due to the exceptional distinction that he attained in any one sphere. He was an impressive preacher, but he would not be regarded as a great pulpit orator. He was a great college president, and we naturally associate him with Dr. Woolsey, Dr. Mark Hopkins and Dr. McCosh; but his administration was not what men are fond of describing as brilliant. He was not exceptionally learned, and though a generation ago his book on Moral Philosophy was very generally used as a text-book, he had no exceptional acuteness as a speculative thinker. But though possessing none of the qualities of greatness in a rare degree he possessed a rare combination of those qualities, and it is in this combination that Dr. Wayland's claim to greatness lies. He was a man of broad sympathies, great earnestness and simple piety. He was sagacious, consecrated to duty, strong and independent in his convictions. He was an old-fashioned Baptist, but not a bigot; he was a profound religious thinker, though not a technical theologian; and he knew how to use his commanding influence in a college pulpit so as to train the intellects and touch the consciences of his hearers.

Dr. Wayland was born in 1796, was graduated in 1813; he studied medicine and after that he went to Andover to study theology: during four years he was a tutor at Union College: accepted a pastorate in Boston in 1821: became President of Brown

University in 1827, and resigned in 1855: for some time after that he was pastor of the First Church in Providence, and died in 1865.

After telling the story of Dr. Wayland's life, Dr. Murray in successive chapters makes a critical estimate of Dr. Wayland as a Preacher, as an Educator, as an Author, and as a Philanthropist.

In these various fields of activity Dr. Wayland accomplished a great work. They were in fact only different channels through which the dominant purpose of his life sought expression; and notwithstanding the various shapes that his activities assumed there was a singular unity in his life. His mind was pre-eminently ethical. He was fond of dwelling upon the practical question of human relations, but always under the dominating idea of Right. As might be expected therefore he was interested in schemes of philanthropy and had strong convictions on the subject of slavery. He was interested also in political economy, especially in the ethical phases of the science; and having dealt with the good of the individual in his "Moral Science," he turned his attention to the good of the community and gave us his "Political Economy." He was interested as every intelligent student of morals must be, in the relations and institutions of society. Juridical philosophy had great attractions for him, and he would have made an ideal judge.

There is no part of Dr. Murray's volume that has interested us more than that which deals with Dr. Wayland as an educator. After a few pages of interesting narrative regarding the history of elective studies in American colleges, Dr. Murray says: "Dr. Wayland must therefore be accorded the credit of taking up and pushing the scheme of elective study at a time, 1850, when it found favor in no Northern College and existed only in the University of Virginia."

FRANCIS L. PATTON.

NOTES.

ENTRANCE EXAMINATIONS.

The entrance examinations will be held simultaneously at Princeton and other points on June 11th and 12th. The local examinations thus far arranged are as follows:

I. For entrance to all classes (including "preliminaries").

1 New York, at the Y. M. C. A. Building, Twenty-third street and Fourth avenue. In charge of Prof. West, with Dr. McCay and Mr. Bentine.

2 Philadelphia, at Association Hall, Fifteenth and Chestnut streets. In charge of Prof. Westcott and Dr. Thompson.

3 In Pittsburgh, in the McClintock Building, corner Market and Liberty streets. In charge of Prof. Magie.

II. For Freshman entrance (including "preliminaries"), and Sophomore entrance when previously applied for.

4 Heidelberg, Germany.

5 Syracuse, N. Y.—Rev. A. H. Fahnestock.

6 San Antonio, Texas—Prof. W. B. Seeley.

7 Wichita, Kansas—Prof. J. M. Naylor.

8 Denver, Col.—

Mr. F. S. Spalding, 2011 Lincoln Ave.

9 Omaha, Neb.—Rev. W. T. Harsha, D.D.

10 Columbus, Ohio.—

Mr. Frank T. Cole, 441 E. Town St.

11 Baltimore, Md.—

Rev. J. P. Campbell, 1113 N. Caroline St.

12 Washington, D. C.—

Tileston F. Chambers, Esq., 1441 Q St., N. W.

13 Cincinnati, Ohio.—

P. A. Reece, Esq., Fifth and Walnut Sts.

14 Chicago, Ill.—

Wm. B. McIlvaine, Esq., 21 Borden Block.

15 St. Louis, Mo.—

Hon. C. C. Allen, Laclede Building.

16 San Francisco, Cal.—

Rev. A. J. Kerr, 1224 Jackson St.

17 Louisville, Ky.—

J. W. Barr, Jr., Esq., 433 W. Jefferson St.

18 Elmira, N. Y.—

Burton S. Chamberlin, Esq., 206 E. Water St.

19 Buffalo, N. Y.—

Prof. F. S. Fosdick, Court and Franklin Sts.

20 Harrisburg, Pa.—

Geo. E. Etter, Esq., 212 Walnut St.

21 Minneapolis, Minn.—

Thomas Peebles, Esq., 512 Wright Block.

22 St. Paul, Minn.—

J. W. White, Esq., Pioneer Press Building.

23 Wilkes-Barre, Pa.—

Thomas H. Atherton, Esq.

24 Scranton, Pa.—J. H. Fisher, Esq.

25 Albany, N. Y.—

David A. Thompson, Esq., 445 Broadway.

26 Corning, Iowa.—Ira P. Clark, Esq.

27 Eufula, Ala.—Rev. S. A. McElroy.

28 Albion, N. Y.—Rev. Edward H. Rudd.

29 Owego, N. Y.—Prof. E. J. Peck.

30 Chambersburg, Pa.—Prof. M. R. Alexander.

ALSO AT SCHOOLS IN THE FOLLOWING PLACES.

31 Geneseo, N. Y.—State Normal School.

32 Saltsburg, Pa.—

Kiskiminetas Springs School.

33 Poultney, Vt.

34 Belmont, Mass.

35 Poughkeepsie, N. Y.—Riverview Academy.

36 Petersburg, Va.—University School.

37 Concord, N. H.—St. Paul's School.

38 Pottstown, Pa.—The Hill School.

39 Great Barrington, Mass.—Sedgwick Institute.

40 Lawrenceville, N. J.

41 Exeter, N. H.—Phillips Academy.

42 Upper Alton, Ill.—High School.

The twenty-third annual meeting of the AMERICAN PHILOLOGICAL ASSOCIATION will be held at Princeton, N. J., beginning at 4 P. M., on Tuesday, July 7th, 1891, in University Hall.

The address of the President of the Association, Dr. Julius Sachs, upon Alexandrine Art, will be delivered in University Hall on Tuesday evening at eight o'clock.

Members intending to be present are requested to send their names at their earliest convenience to Prof. A. F. West.

The meeting will continue through the 8th and until the afternoon of the ninth. Members of the Princeton Faculties, both in the College and Seminary, and others interested in philological studies are invited to attend the sessions of the Association.



CASPAR WISTAR HODGE, D.D., LL.D.

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. III.

NOVEMBER, 1891.

NO. 4.

CASPAR WISTAR HODGE, D.D., LL.D.

It will be hard perhaps for the general public to estimate the greatness of the loss that Princeton has sustained in the death of Dr. Caspar Wistar Hodge. His life was singularly quiet and uneventful; and it may be doubted whether even in Princeton it was generally known how much the simple weight of his opinion was indirectly influencing the Church. Unseen himself, he was a most interested observer of events. Clear in his judgment and unalterable in his convictions, he was in all matters and particularly in theological and ecclesiastical matters a wise counsellor, and his judgment had great influence in shaping or in confirming the judgments of other men who took a more active part than he in public affairs.

He wrote but little for the press and that little was usually in the form of book reviews which, while remarkably lucid and discriminating were studiously objective in their nature and disappointingly lacking in any expression of his own opinions. It is to be regretted that in the department of New Testament study where he had such exceptional right to speak with authority his disinclination to authorship should have deprived the Church of the benefit of his ripe learning and penetrating judgment. It is too soon to say whether his lectures are in a form that will justify

their publication in a volume. Such a volume, prepared under proper editorial supervision, would be eagerly welcomed by Dr. Hodge's pupils all over the world, and would supply a need in our theological literature. Lacking the finishing touches of the author's hand, it would necessarily be incomplete and perhaps be even fragmentary, but it would nevertheless be a splendid fragment.

The greater part of Dr. Hodge's life was spent in Princeton. He was born here, February 21, 1830, and lived here until 1853, when, after a four years' course of theological study, he was graduated from the Theological Seminary. During his boyhood he enjoyed the friendship and guidance of Dr. Addison Alexander, whose formative influence during those early years was visible in all his after life. Dr. Hodge's relations with this singularly gifted man were very remarkable and constitute a feature in his life that deserves fuller treatment than can be given to it in this brief sketch. Dr. Alexander was his teacher and friend. He prepared him for college and imbued him with the scholarly ideals that made him so critically painstaking in his work and at the same time so dissatisfied with it. Dr. Hodge was graduated from Princeton College with the highest honors of his class in 1848. At a later date his *alma mater* recognized the distinction he had won as a

theologian, by conferring upon him the degree of D.D. in 1869, and that of LL.D. in 1891. He was a tutor in the College for one year while carrying on his studies in the Theological Seminary, and during another year was a teacher in the Edgehill School. He was licensed to preach by the Presbytery of New Brunswick in 1853 and was ordained to the ministry by the Presbytery of New York November 5, 1854. His first pastoral charge was the Ainslie Street Presbyterian Church, Williamsburgh (Brooklyn, E. D.), which he served for one year as a stated supply and then for two years as a settled pastor. In 1856 he became pastor of the Presbyterian Church in Oxford, Pa., remaining there until the death of Dr. Addison Alexander in 1860, when he was called to the vacant chair, the title of the professorship being that of New Testament History and Biblical Greek until 1879, when it was changed to that of New Testament Literature and Exegesis.

The latter change was consequent upon the death of Dr. Hodge's eminent father, Dr. Charles Hodge, who through the greater part of his long career as a Professor in the Theological Seminary taught both Systematic Theology and New Testament Exegesis. It was one of the blessings of Dr. Charles Hodge's richly dowered life as well as one of the blessings of the institution that has been singularly favored with a succession of able and godly men, that when he rested from his labors his work could pass without interruption and by a natural transition into the hands of his two gifted sons: Dr. A. A. Hodge, who but a little before had been called to Princeton from the Seminary in Allegheny, taking the department of Systematic Theology, and Dr. C. W. Hodge that of Exegesis. It had been the hope of the Church that loved and honored these men as she had loved and honored their father, that they would

both be spared for many years to come in the work which they were doing with such conspicuous success. But this hope has been sadly disappointed. Dr. A. A. Hodge died after a short illness November 11, 1886, and now, after months of anxious waiting, hoping often against hope, we have been forced to submit to a divine appointment that has taken away the last of this great triumvirate.

Dr. Hodge's illness began in the winter of 1890, and, though not deemed serious, it soon required him to suspend his lectures at the Seminary. The directors of the Seminary gave him a year's leave of absence, and it was hoped that change of air and relief from immediate anxiety would prove beneficial and lead to full recovery. He spent a part of the summer in the Adirondacks, but the looked for improvement did not come. A little before the opening of the Seminary he returned to Princeton greatly exhausted. He grew weaker daily, and on the afternoon of Sunday, the 27th of September, he quietly passed away. To his sorrowing family—his widow, three daughters and only son who bears his father's name—we extend our heartfelt sympathy, with the feeling however, that even death seems less cruel when those who have been bereaved can look back upon a life so full of true nobility, so pure and above reproach as that of Caspar Wistar Hodge. A more unselfish man we never knew; a man so little affected by self-regarding motives one rarely sees. Devoted to his family, considerate of his friends, affectionate to those who were admitted to intimacy, wide-awake in regard to public affairs, clear in judgment, fixed in purpose, guiding his life by principle, a reverent Christian, a tenacious believer in the theology of his Church and jealous—to a degree that depressed and saddened him—of the influences that tended to dilute her faith or lower her testimony,

he was, take him for all in all, a man whose like we shall never look upon again.

Dr. Hodge was deeply interested in the progress of his *alma mater*, and though conservative by temperament and sometimes disposed to criticize adversely, he was nevertheless in full sympathy with the university ideals and university methods which characterize the Princeton of to-day. He was essentially an academic man. This was nowhere more visible than in his preaching which was preeminently suited to the wants of the intellectual and theologically educated audience that was accustomed to listen so eagerly to him in the Seminary chapel. His sermons were rich with the results of a profound study of the New Testament, pervaded by a refined spirituality and expressed in a style that was wonderfully clear, simple and unaffected.

But Dr. Hodge's great power was in the class-room. He worked for his students and was revered by them as few professors are. His intellectual honesty, his fairness, his candid dealing with difficulties, his wisely balanced judgment, and above all the religious impression that his lectures unfailingly left upon his pupils, were marked features in his professorial life and served to make him what he was, the ideal teacher of the New Testament.

Dr. Hodge was a man of few words. His life revealed him: he never called attention to himself. His death is an irreparable loss to the Theological Seminary which he served through a period of thirty-one years. His intimate friends looked up to him, leaned upon him, and loved him, and it is with feelings of unspeakable sadness that they think of him as having gone out from their company.

FRANCIS L. PATTON.

THE SPENCER TRASK LECTURESHIP.

A gift announced at last Commencement which is deserving of more than a passing announcement is that of \$10,000 by Mr. Spencer Trask of New York, to be used as a fund for public lectures. Its object is to bring to Princeton every year one or more prominent lecturers who shall select for their subject some topic of the day that will be of interest to the whole College. In order to prevent any possible favoritism it is made a condition that the lecturers shall be in no way connected with the College. The income of nearly \$500 would usually ensure half a dozen lectures.

It is certain that Mr. Trask has provided the solution of one of our crying evils. The finances of the College have never allowed it to provide such free public lectures, and what has hitherto been done for this side of College life has been done by private initiative. The incentive and stimulus which are derived from such courses at other universities are so evident that both our faculty and student body have often lamented our unfortunate position in this respect. The students, being unused to regular lectures of this kind, it has happened that when lecturers have been occasionally called here their lectures have usually been so scantily attended as to make us blush for the intellectual activity and love of knowledge of our College. It was like advertising to the world our scholastic nakedness; and those who had made the effort to offer new intellectual pabulum were usually not encouraged to make another attempt. It is true that a slight admission fee was sometimes charged.

But with a regularly established course of lectures, such as the Trask fund will enable us to have, a tradition will doubtless soon be established in Princeton

which will lead every bright man to look forward with eagerness to these intellectual treats. The series will be opened on November 18, by Sir Edwin Arnold, the well-known English writer. We hope to owe to Mr. Trask's generosity the presence in Princeton in future years of many eminent men.

THE AMERICAN PHILOLOGICAL ASSOCIATION.

The twenty-third annual meeting of the American Philological Association was held in Princeton, July 7th to 9th, 1891. It was one of the largest, if not the largest meeting in the history of the Association, as well as one of the most interesting.

The sessions were held in University Hall and most of the visiting members were lodged in the same building.

Among the prominent members present were Professors Clement L. Smith of Harvard University, Gildersleeve of Johns Hopkins University, March of Lafayette, Seymour and Peck of Yale University, and Garnett of the University of Virginia.

The number of members present was between sixty and seventy. The proceedings were opened by an address of the President of the Association, Dr. Julius Sachs, of New York City, on Alexandrian Art, on the evening of July 7th. This was followed by an address of welcome by President Patton. The reading and discussion of papers occupied almost exclusively the remaining sessions. Professors Hunt and West of Princeton were among those who read papers. At the closing session the Association passed resolutions expressing their appreciation of the attentions shown them by the College and adjourned to meet next July at the University of Virginia.

One of the pleasantest incidents of the last hour of the session was the presence of Dr. McCosh who delivered a short ad-

dress on the philosophical ideas which lie at the basis of linguistic study.

The President of the Association for next year is Professor Hart of Trinity College.

THE NEW SPECTROSCOPE OF THE HALSTED OBSERVATORY.

By C. A. YOUNG.

Through the liberality of one of the best friends of the College the Halsted Observatory has lately received a powerful spectroscope, which in several respects is more perfect and complete than any other before constructed. It has been designed as a sort of universal instrument, to cover, as nearly as possible with a single apparatus, all the ground of Astronomical Spectroscopy. It is arranged for solar work, either in the study for sun-spot or chromosphere spectra, or for the observation of the prominences; also for the study of stellar spectra with high dispersion in order to follow up the work of Vogel and others upon the motion of stars in the line of sight; and it has a low-dispersion prism which makes it available for observations upon the spectra of comets or other faint objects. Moreover, the construction is such that the observations can be made either visually or photographically.

Naturally, the attempt to cover so much ground with a single instrument renders it somewhat complicated; but it has not been necessary to sacrifice, nor even seriously to compromise, any one object in order to attain others.

The instrument has been constructed by Mr. Brashear of Allegheny, the same optician who made the spectroscope for the Lick Observatory; and great credit is due him and his foreman, Mr. Klages, for the great skill and ingenuity with which they have carried out the general plan, and for the admirable accuracy and finish of the workmanship.

A stiff but light framework of four steel tubes carries the spectroscope, and is attached to the great telescope by two rings which slip over the seven-inch brass tube that forms its tail-piece. This mode of attachment permits the spectroscope to be rotated freely around the optical axis of the great telescope, and to be clamped firmly in any position. The collimator is mounted centrally in this framework in such a way that it can be adjusted with respect to the optical axis, and also can be moved longitudinally a distance of about four inches in order to bring the slit-plate accurately into the focal plane for rays of any color. (The focus of the 23-inch object-glass for the violet portion of the spectrum near the lines known as *H* and *K* is more than three inches beyond the focus for the green rays.)

The slit-plate is an elaborate and beautiful piece of workmanship; the jaws of the slit are most carefully finished, and there are arrangements for varying the opening from zero to half an inch in width, and from zero to an inch in length, as well as for moving it sideways. The plate carries a set of colored screens which can be interposed at pleasure; also (when needed) a "comparison reflector" for throwing into the slit the light of an electric spark, the electrodes between which the spark is formed being carried by a holder attached to the steel tubes of the supporting frame. There is also a "rotation prism," which can be attached at pleasure, and enables the observer to make any portion of the sun's limb parallel to the slit without having to rotate the spectroscope into uncomfortable positions.

The collimator has an object-glass two and a half inches in diameter, with a focal length of thirty inches, and the same is true of the view-telescope. This is supported by a pair of light but stiff arms which are firmly attached to the steel

tubes, and it is held by these arms in such a position that it receives centrally the rays from the grating or from the prism-train as the case may be. When the grating is in use a short pair of arms is used which holds the view-telescope in a rigidly fixed position; when the grating is replaced by the train of four prisms used in stellar work, a second and longer pair of supports is substituted, so arranged as to permit the necessary motion of the view-telescope over a considerable arc, but with the means of clamping it firmly in any position. The necessity of making such a change is of course objectionable, but it is unavoidable, and Mr. Brashear has ingeniously reduced the inconvenience to a minimum without sacrificing the indispensable firmness.

The collimator and view-telescope are each provided with two separate object-glasses, one pair to be used for all visual observations, the other for photography. It was originally intended to have but one pair, with the component lenses made of the new Jena glass giving a practically perfect color-correction through the whole range of the spectrum. But Mr. Brashear, after considerable experience in the matter, has reluctantly come to the conclusion that it is not yet practicable to construct such lenses, or rather that such lenses when constructed cannot be relied on to keep their polish for any great length of time; the glass soon "rusts."

The tube of the view-telescope is made in two sections, so that the eyepiece end with its micrometer can be easily removed and replaced with a camera tube carrying a 4×5 plate-holder.

If focussing the spectroscope the two object-glasses of the collimator and view-telescope are moved simultaneously and equally by a very ingenious arrangement which couples them together and still leaves the view-telescope all the necessary

freedom of motion. It may be stated here that all the instrumental adjustments of every kind are managed by milled heads easily accessible by the observer without removing his eye from the eyepiece; also that there are graduated scales to each important adjustment, so that a record can be made of the precise state of the instrument at any observation.

For solar work the "dispersion piece" is a magnificent five-inch Rowland grating of 20,000 lines to the inch ruled on a speculum metal plane. The definition of this grating is superb, and its spectra are remarkably free from "ghosts," though not absolutely so. At present, through the kindness of Mr. Brashear, we have also on loan a second, smaller but very fine grating of 14,400 lines to the inch, which can be at any time substituted for the other, and used for verifications. The grating is so mounted that it can be rotated by the observer in the plane of rotation as usual, and also so that it can be slightly adjusted in a plane at right angles to this, as is sometimes necessary, and this, as has been said, without taking the eye from the instrument.

The prism for comet work has faces about $3\frac{1}{2}$ inches by 3, with a refracting angle of about 25° ; it is silvered on the back, and when substituted for the grating furnishes by reflection a short but brilliant spectrum, without requiring any other change of adjustment or arrangement.

For observation of stellar spectra there is a train of four large compound prisms of Jena glass faced with wedges of crown glass. The faces of the prisms measure about two and a half inches by three, the back of the prism being fully four inches long. The angles are calculated to transmit the *H* and *K* lines of the spectrum with a minimum deviation of about 165° . The prisms are mounted in a metal box, and connected with each other in such a

way that the adjustment for minimum deviation is easily made for all four at once by simply moving a sliding rod at the eye end of the view telescope. When this prism is used the grating-box with its appendages is removed and the prism-box substituted; the view-telescope also has to be taken off and replaced with the proper supporting frame work. The whole operation can be performed in less than ten minutes.

The optician has encountered considerable difficulty in connection with these prisms; one of the four originally sent proved to be unsatisfactory on account of unequal density in the glass, and the prisms are now in the maker's hands to have the faulty one replaced. Nothing therefore has yet been done with the instrument used as a prismatic spectroscope.

With the grating some preliminary work has been done, both in the way of visual observations and by photography. About fifty plates have been exposed, more or less successfully, and a considerable number of good negatives have been obtained, mostly relating to the ultra-violet portion of the spectra of the chromosphere and prominences, with a few spectra of sun-spots.

The plates confirm entirely the results first photographically reached by Hale of Chicago early last summer, and since then by Deslandres in Paris, as to the constant and brilliant reversibility of the *H* and *K* lines in the spectra of sun-spots, and of the chromosphere and prominences. (The fact of this reversibility had been known ever since 1872 as the result of the *visual* observations made by the writer at Sherman, Wyoming.) The photographs also show, as do those of Hale and Deslandres, in the spectrum of the solar chromosphere, the remarkable ultra-violet series of bright Hydrogen lines which are so conspicuous and characteristic as dark lines in the

spectra of the stars of the first or Sirian type, but are hardly visible in the spectrum of the photosphere of the sun, and in the spectra of the sun's stellar congeners.

A partially successful attempt has also been made to photograph the spectrum of a star with a grating; in the negative of the spectrum of Vega, made with the exposure of half an hour, the principal lines are unmistakably visible; but the impression is extremely faint, and the result is interesting only as being, so far as I know, the first instance in which any impression at all has been obtained of a star-spectrum by means of a grating.

As a first fruit of visual observations with the new instrument may be mentioned the discovery that the bright red line, which often appears in active prominences at 6679 of Angstrom's scale, (No. 2 of the catalogue of chromosphere lines), is distinctly less refrangible than the Iron line of which it has hitherto been supposed to be the "reversal." The behavior of this line has always been a mystery, since there was no obvious reason why it should behave so differently from the other Iron lines of the spectrum near it. It is now certain, however, that, whatever may be the substance to which this line is due, it is not Iron.

A GIFT TO THE ART MUSEUM.

Through the generosity of Thomas Shields Clarke, Esq., '82, the Art Museum has received a fine copy of the Nurenberg Chronicle, an Italian Antiphonal of the XIV century and seven old vellum documents with pendent seals. The Nuremberg Chronicle, a general history of the world printed in 1491, is of value as being one of the earliest of printed books extensively illustrated with wood engravings. More than two thousand wood cuts of varied character and merit enliven its

pages. The more important of these were executed by Wolgemuth, the master of Albrecht Dürer. Some are of immense size, covering entirely or nearly so the small folio page. The illustrations appear to have been in many instances purely symbolic, for we find the same wood-cuts serving to represent historical characters of very different periods; even towns as unlike each other as Naples and Perugia are represented by the same engraving.

The Antiphonal in its old binding has evidently been long in use. It is apparently Italian work of the XIV century and contains ten miniature paintings besides a large number of capital letters of very intricate design.

The documents with attached seals are of various characters and belong to different periods. Three date from the XVI century, one from the XVII, two from the XVIII and one from early in the present century. One is an ecclesiastical document, the remainder are civil documents; two are in Latin, the others in German. Amongst them is a decree by the Venetian Doge Francesco Morosini, dated May 10, 1691. It was this Doge, who in the war between the Republic of Venice and Turkey bombarded the Acropolis at Athens and laid the Parthenon in ruins. The present document refers to financial obligations of a certain Franciscus Pasta and has attached to it a leaden impress of the Ducal seal. The ecclesiastical document signed by Stephanus a Francica, general of the Minims of S. Francis of Paola presents to Franciscus the Prior and to Luigi de' Quirini and his family plenary indulgence and other prerogatives for their donations toward the rebuilding of the church of S. Bartolommeo in Venice. It is dated 1585; the church was rebuilt in 1626. The German documents illustrate old German methods of making conveyances of property and issuing laws,

ORIGINAL CONTRIBUTIONS.

THE NAME AND MEANING OF THE
GNOSTIC ÆONS.

By A. L. FROTHINGHAM, JR.

It has been usually taken for granted by writers on the Gnostic sects that the spiritual entities called *æons* (*aiōnes*) which were especially prominent in the system of Valentinus and those of his followers were so called because of their *eternal* character. I believe, however, that they were in reality more closely connected with ideas of *place* than *time*. The word *aiōn* in the sense of "age, period of existence, eternity," dates back to the earliest period of classic Greek. In this same sense and in that of "the world, the course of things," it was used by St. Paul. The plural *aiōnes* was taken to mean "eternal beings"; that such a meaning was attached by the Gnostics themselves to their mythological terms appears to be an assumption on the part of modern writers. I wish to propose a different solution on two grounds, the philological and the mythological. To clear the way it will be merely necessary to recollect that in the Gnostic System the æons were emanations from the first principle, revelations of itself intermediate between it and our created universe with which it could hold no direct communication. With Valentinus they were within the divine sphere, the *pleroma*; in the later *Pistis Sophia*, they are for the most part in a group that forms a separate middle sphere of existence. Their general characteristic is not eternity, because they suffer change and are finally absorbed into the first principle. Their central idea is rather that of relation and position; of place rather than time. For they are not promiscuously considered, but are endued with unequal knowledge, with different qualities and powers, according to the order of

their emanation, and their consequent position of greater or lesser proximity to the first principle from which they proceeded.

That their name, *æon*, really expressed this idea of place rather than that of duration in time was suggested to me in reading the Syriac text of a work of early mystic theology which I am preparing for publication, the "Book of Hierotheos," which contains large Gnostic elements as well as traces of Neo-Platonism. In this work, written towards 500 A. D. by a Syrian monk, the ideal process by which the mind is reunited to the first principle from which it descended by emanation, is described. The spirit worlds through which the pure mind rises bear strong analogies to the Gnostic categories. At a certain point in the ascent it is described as passing through a series of spheres called *avanē*, אַוַנַּא, whose character reminds one at once of the Gnostic æons. Turning to Payne-Smith's dictionary I found it noted that Bernstein regarded this Syriac word as the equivalent of the Gnostic Greek *aiōnes*. But as a commonly used and purely Syriac term its meanings are given as "*diversorium, hospitium, locus habitandi, mansio*," especially in the connection of "(heavenly) mansions," "dwelling-place (of the blessed)," "habitation (of the dead)," etc. This common meaning of the Syriac word is that most appropriate to the Gnostic æons and it seems a natural inference that the Syriac word is the original term and was transliterated into Greek, giving the equivalent *avana* = *aiōn* with the advantage of making use of a Greek word already in good standing. Before this hypothesis can be regarded as well grounded several points must be considered.

1) Is the equation *avana* = *aiōn* philologically possible and probable?

2) Is it probable that a Gnostic term should be of Syriac or Semitic origin?

3) Are there any proofs in Gnostic writings that the meaning "place, station, habitation," is more germane to the æons than that of "eternity"?

The answer to the first question is perfectly easy. That Syriac *r* was used as the equivalent to Greek *ι* in the first syllable of a word, and vice-versa, is quite evident from Payne-Smith's dictionary alone, from which I take the following

אורין	=	αἰθήρ
אוריץ	=	αἰετός
אויא	=	Οἶα
אונאנרא	=	οὐνάγρᾱ
אונס	=	ὄντος
אורס	=	αἶψα
אופי	=	οἶφι

This list could easily be doubled, were it necessary, but these examples are sufficient to remove any objection to the equivalence of the two words.

The next point is, then, the probability of the use of a Syriac word as a Gnostic term. The Semitic element in the terminology of the Gnostics and Ophites is a well known fact. The earliest leaders of these sects were Syrians or Palestinians, and the Alexandrian branch was founded by and partly composed of Syrians. Such were Simon Majus, (?) Menander, the Naasenes or Ophites, Cerinthus, Saturninus, Tatian, Bardesanes, and even Basilides. It is natural that, as our informants regarding Gnostic doctrines—Irenæus, Hippolytus and Clement wrote in Greek—they should give us the Gnostic terminology in Greek form or translation. The exception would be in some cases where the terms are considered as proper names and so be preserved. Thus the term Naasenes (נחס) is not quite superseded by the term Ophites (Οφίτες) and we have the following other Semitic names preserved to us in Greek transcription; the Adam [Kadmon] of the Kabbala (in *Pistis Sophia*); the demi-

urge *Ialdabaoth* (Ophites, *Pistis Sophia*); the divine Wisdom *Achamoth* (חכמיה) or *Sophia* (Ophites, Cainites, Valentinus, etc.); the title *Caulacau* as given by the disciples of Basilides to the Saviour of the world (Is. xxviii, 10). The names of the Valentinian æons, as given by Epiphanius in Aramaic-Syriac (*Hær.* xxxi, 26,) are considered by the historian Matter to be the original names. The sect of Marcus, a pupil of Valentinus, used Hebrew terms, and some of the Ophite sects used Aramaic almost exclusively. The only long original text which could throw further light upon this question of nomenclature is the Gnostic-Ophitic work entitled *Pistis Sophia*. This is full of Semitic terms, especially as names of the essences that emanate from the original principle. Such are the names of the great Father of the archons, demiurges and angels; *Sabaoth*, *Ito*, *Ien*, *Ialdabaoth*, *Iachthanabu*, *Abiuth*, *Ariel*, *Ialuba*, *Bainchôôch*, *Jabaoth*, *Adamas*, etc., etc. It would appear, therefore, that from the beginning to the close of the Gnostic and Ophitic period the use of Semitic words to express their most important mythological entities was quite common and probably more common than our present very imperfect and Grecising authorities would lead us to suppose. There is therefore no objection on this score to be urged against the Syriac origin of the term *æon*.

Finally, the point that remains to be dealt with is whether there are any proofs, in extant Ophitic or Gnostic writings, or in the summaries of their systems made by early Christian writers, that the meaning *place, station, etc.*, was attached to the term *æon*. I shall refer mainly to a work already mentioned, *Pistis Sophia*, because, though its date and authorship are unknown, its antiquity, authenticity and importance are unquestioned and it is the only text of any great length that has been preserved. It is fortunate that the æons are here mentioned several hundred times

and described so minutely as to leave no possibility of doubt. On the very first page the *aiōn* is made practically synonymous with *τόπος* (place) and *τάξις* (array, station); it is also called a *habitaculum*, and often specifically a *τόπος*.

The twelve æons of the *Pistis Sophia* are spheres of existence one above another, stationary, which are figuratively entered by gates, are inhabited by spirits ruled by archons and guarded by door-keepers; each one is cognizant of the one below it, but ignorant of the one above it, except *Adamas*—the Adam Kadmon of the Kabbala—who is lord of all the æons. Each æon has its special degree of illumination; its special mystery. Far above this group, in quite another sphere, is the thirteenth æon, where Wisdom herself, the *Pistis Sophia*, was placed.

In the system of Valentinus who first made use of the æons as an important part of Gnostic mythology, the æons have more the character of revelations of attributes of the first principle. From the little we know of his system he conceives them to exist within the divine sphere or *pleroma*. But they are successive, progressive and unequal emanations of placed, as I remarked above, in the position of graduated intermediaries between the ineffable and our world. If we knew more of the details of the ideas promulgated by Valentinus, they would doubtless be somewhat analogous to, but conceived in a more spiritual and internal manner than the descriptions in the *Pistis Sophia*.

The philosophical consequence is not without interest. We have now a clearer conception of what the æons were in the Gnostic mind as explained by their name confirmed by the text. Instead of being spiritual forces without fixed relationship, they are spirit worlds that form a continuous chain connecting the unknowable creator with those dwelling in the material

universe who are thus enabled by a gradual rise to undergo a process of redemption until all things are re-absorbed into that from which all proceeded.

This chain of beings appears as related to logical processes of the intellect and to be far more connected with ideas of place than of time, although in different degrees according to periods. The intellectual character of this process is of course in harmony with Gnosticism, which is pre-eminently an intellectual process.

ON DULCARNON, ELEFUGA AND PONS
ASINORUM AS FANCIFUL NAMES
FOR GEOMETRICAL PROPO-
SITIONS.

By A. F. WEST and H. D. THOMPSON.

The definitions in the Century Dictionary and the articles in the New York *Tribune* of January, 1891, have served to call attention again to these curiosities in the history of medieval mathematics and logic. The first of these may be said to have been fully explained by means of articles in the *Athenæum* of Sept. 23d, 1871, (page 393,) and in *Notes and Queries* (seventh series, vol. iv, page 130). The other two have not been so fully treated and may be additionally illustrated and explained.

Before doing so, it may be well to summarize what is perhaps already sufficiently known regarding all three of these strange terms. *Dulcarnon* is the Anglicized Arabic word *Dhū'lqarnain*, which means two-horned and was applied either to any dilemma or, more especially, to the two-horned forty-seventh proposition of the first book of Euclid, which was so named from the sticking up of the two smaller squares at the top of the figure used in the old manuscript geometries. The classical passage in English literature is in Chaucer (*Troilus and Creseyde*, III., 929-935):

Cryseyde answered: * * * * *

'I am til god me bettre mynde sende

At dulcarnon right at my wittes ende.'

Quod Pandaurus 'ye Nece wol ye here.

Dulcarnon called is flemyng of wrecches.

It seemeth hard, for wrecches wol not lere.'

It will be noticed that Chaucer uses Dulcarnon first in the sense of a dilemma "at my wittes ende" and secondly in the mathematical sense which he calls the "flemyng of wrecches." Now the "flemyng of wrecches," as will appear later, is a name for the fifth proposition of Euclid, and Chaucer has inaccurately spoken of this fifth proposition as Dulcarnon, thus perhaps becoming responsible for later confusion in the use of the term.

It is worth noticing that in Billingsley's Euclid, the first English translation, which appeared in 1570, Dulcarnon is properly applied to the forty-seventh proposition.

Elefuga is the medieval name for the fifth proposition of the first book of Euclid. Its definition is to be found in Roger Bacon (died in 1296). Anthony Wood in his "Annals of Oxford" gives an account of Roger Bacon and says incidentally "wherefore the fifth proposition was called Elefuga, that is, according to our author, 'fuga miserorum'; 'Elegia' enim dicitur Græcis 'miseria' et elegi sunt miseri." The passage from Roger Bacon is found in the sixth chapter of his "Opus Tertium" and is as follows: "Quinta propositio geometriæ Euclidis dicitur Elefuga, id est, fuga miserorum; elegia enim Græce dicitur, Latine miseria; et elegi sunt miseri." Of course Roger Bacon's etymology of Elefuga is very dubious, though there is no doubt that his "*fuga miserorum*" is the same thing as Chaucer's "flemyng of wrecches," which means means the flight of the wretched. The writer in the *Athenæum* suggests that Elefuga is a hybrid Low Latin term not improbably derived from ἡλεός and *fuga*, but it may possibly be of Arabic origin.

Pons Asinorum is the familiar school-name for the fifth proposition of Euclid, although its origin is not to be sought in the history of mathematics but of logic, from which it must have crossed into mathematics.

The term Dulcarnon thus appears at the close of the fourteenth century in Chaucer, Elefuga at the close of the thirteenth century in Roger Bacon, while Pons Asinorum is of apparently undefined antiquity.

This note is intended to extend our knowledge of Elefuga by way of further illustration and to trace out more fully the history of Pons Asinorum, principally by the aid of Prantl's *Geschichte der Logik*.

I. As to Elefuga.

The fact that Roger Bacon takes pains to define this term, both etymologically and mathematically, may be taken as indicating its introduction into the learning of England in his life-time, or, at least, in the thirteenth century. Shortly before his time it used as a familiar expression by Alanus de Insulis (died 1202) and later by Richard de Bury in the middle of the fourteenth century. The passage from Alanus is found in his *Anticlaudianus* (III. 6.) in a fanciful description of Geometria, who is represented as teaching, among other things,

"Hujus tirones cur artis eleufuga terret,"

that is, "Why the Eleufuga frightens freshmen in geometry."

The passage from Richard de Bury's *Philobiblon* (cap. XIII.) reads: "Quot Euclidis discipulos retrojecit Elefuga quasi scopulos eminentes et abruptus, qui nullo sealarum suffragio scandi posset! Durus, inquit, est hic sermo; quis potest eum audire?" which may be translated, "How many pupils of Euclid has the Elefuga thrown back as though it were a steep or jutting cliff that could be scaled by no

help of ladders! It is a hard saying, they say; who can hear it?"

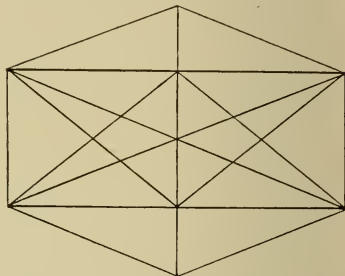
It is evident that both of these passages give the same meaning to *Elefuga* as is found in Roger Bacon, and that the fifth proposition was an object of terror in the middle ages to beginners in Euclid. That the term itself was not well understood by medieval copyists may be argued from its various manuscript spellings, *Elefuga*, *Elefuga*, *Elifuga*, *Eleofuga*, *Eleufuga*. It is also possible that De Bury, when comparing the fifth proposition to a "steep and jutting cliff that could be scaled by no help of ladders," had in mind a high and sharp-pointed geometrical figure similar to the one found in our geometries, instead of the broad low, obtuse-angled, bridge-like figure for the same proposition, which naturally became associated with the name *Pons Asinorum*.

II. As to *Pons Asinorum*.

The origin of this expression is to be found in scholastic logic in connection with a scheme for exhibiting the finding of the middle term by a diagram.

As late as Rabelais (died 1553) the expression "pont aux asnes de Logique," (*Gargantua* II, 28,) is to be found in literature and refers to the difficulties of the syllogism. Going backwards from this point in our search we meet, first of all, with Nicholas Clenard (died 1542), a writer on dialectics, who preserves in one of his *Epistles* the following saying: "*Inveniamus medium (in dialectica) non in ponte asinorum,*" etc., (*Epp.* I. 20). Clenard means to say that he abandons the device used for finding the middle term in the syllogism, and known in his time as the *pons asinorum*. Still earlier is the follower of Duns Scotus, Petrus Tartaretus, who wrote (about 1480-90) on the *inventio medii* as follows: *Ut ars invenienti medium cunctis sit facilis, plana atque perspicua, ad manifestationem ponitur sequens figura, quæ com-*

munitur propter ejus apparentem difficultatem pons asinorum dicitur. (Prantl, XXII, note 165);—"That the art of finding the middle term may be easy and clear to all, there is added for its explanation the following figure, which from its apparent difficulty, is commonly called the *pons asinorum*." The following figure is accordingly appended:



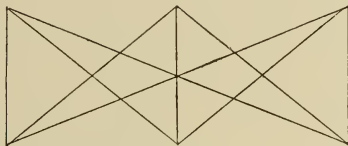
The figure is remarkable enough and the statement of Tartaretus regarding it is unmistakable. It is the figure for finding the middle term and was commonly called in his time the *pons asinorum*.

Going backwards a century and a half, we meet the writings of Jean Buridan of Arles (died 1358), a pupil of William of Occam and for a time Rector of the University of Paris,—connexions which show his opportunities for knowing what was in the learning of his time. Our knowledge of his acquaintance with the *pons asinorum* as a device of logic unfortunately does not come directly from his own writings, although he seems to have left a treatise on the subject, entitled *De Asino*. At least Frobesius published at Helmstadt in 1748 an historical and critical disquisition, "*De Johanne Buridano ejusdemque Asino.*" What we know of Buridan on this subject comes through Sanerius, a late scholastic writer on the dialectics of Dun Scotus. Sanerius's works are ap-

parently unobtainable at the present time. Prantl, even after repeated efforts, was unable to find any copy, and therefore his discussion of Buridan (XX. note 134,) is based upon the account given by Brucker, who had read and quoted what Sanerius had to say on the subject (*Historia Critica Philosophiæ*, III, 855. Ed. 1756). Brucker's account of Buridan, translated into English, is as follows: 'He made a name for himself in logic by means of a definite rule (*certa regula*) for finding the middle term, which is called the *pons asinorum* and is defined by one of the late scholastics as 'a device (*ars*) for finding the syllogistic middle term, or a mode (*modus*) of showing in general how extremes disjoined by negation are to be copulated; and it is called the *pons*, because the extremes separated by negation are united as the banks of a river are joined by a bridge. It is likewise called the *pons asinorum* because those who are skilled in the art of logic are thus separated from the dullards.' Brucker's "later scholastic" is Sanerius. Continuing his own account, Brucker says, "It seems that we must distinguish between the *pons asinorum* and a logical *asinus* of Buridan, which he describes as standing midway between equally attractive bundles of hay, and in danger of perishing from hunger, either by reason of his impotent or his equally balanced will." Brucker means that Buridan made the "ass" serve more than one kind of logical illustration. However, in the above statements he does not represent Sanerius as attributing to Buridan the invention of the figure or of the expression *pons asinorum*, although Prantl seems to think so (XX, note 134.) Still the statement that Buridan achieved fame in logic by a "definite rule" for finding the middle term and a "rule" called the *pons asinorum*, may imply that Buridan knew a figure of some sort, and the quotation from Sanerius, describing the *pons*

as a "mode showing in general" how to join separated extremes as a bridge joins two sides of a river, implies that Buridan did know a figure essentially the same as the one we have already met with in Tartaretus.

But still earlier is the Arabian philosopher Averroes (died 1198). In his Commentary on the Prior Analytics of Aristotle (folio 87 r., Venice Ed. 1552), the subjoined figure is given to serve as a device for finding the middle term in the Aristotelian syllogism, and Prantl states that this figure passed from Averroes into the Latin writers of the scholastic period.



The figure in Averroes is headed: *Figura methodi pro medio in singulis conjugationibus et utilibus et inutilibus inveniendi, ex Antiquis excerpta*. That is, a figure for finding the middle term. But of more importance is the last phrase, *ex Antiquis excerpta*, which shows the device to be older than Averroes. Who the "Ancients" are, unless they are the Greeks, is difficult to imagine. Additionally noticeable is the fact that Averroes does not call his figure the *pons asinorum*, so that it looks as though Buridan was the one who at least brought the expression into public notice.

If the parts of the figure in Tartaretus are compared with the diagram in Averroes, it is evident that the later figure is the diagram of Averroes with certain unimportant additions. In fact, if from the figure of Tartaretus the parts which he calls "*extranea*" be removed, the figure of Averroes remains.

Finally, the expression *pons asinorum* is thus as old, if not older, than Buridan,

and is the name of a figure which is much older than Averroes.

We have seen that as late as Rabelais (1553) the term was still applied to a device of logic, and it is also a fact that in Billingsley's Euclid (1570) the term is not attached to a geometric theorem, so that its crossing into mathematics probably occurred at a later date.

THE PRINCETON SCIENTIFIC EXPEDITION OF 1891.

By W. B. SCOTT.

The ninth geological expedition which the College has sent out to explore the Tertiary formations of the West, selected

as its field the valley of Smith River or Deep Creek, as it is variously called, in central Montana. This choice was made both because comparatively little was known of the fauna of this most interesting transition formation, and because the policy of the Museum has been to obtain representative series of fossils from all of the Tertiary horizons, so far as these could be reached in the summer season. Previous explorations had been made in the Wasatch, Bridger and Uinta Eocene, and the White River and John Day Miocene, now the Deep River (*Ticholeptus*) beds have added to the list, while the Puerco Eocene and the Loup Fork Miocene yet remain to be examined.



MAP OF UPPER SMITH RIVER VALLEY, MONTANA.

DRAWN BY W. B. HARRIS FROM A SKETCH BY O. C. MORTSON.

The expedition, consisting of Professors Scott and Magie, and Messrs. Butler, Benet, Coulter, Hosford, Jefferson and Stevenson, of the present Senior Class, assembled early in August at Great Falls, Montana, which

had been chosen as the outfitting point, and where the necessary supplies—horses, wagons, &c.—were procured. From here the party marched southward about 125 miles to the neighbourhood of White Sul-

phur Springs, where a permanent camp was made, and the work of collecting begun. As the deposits are comparatively limited in extent, the work could be carried on with a thoroughness which is not often attainable in such hurried trips. The party had the good fortune to secure the services of Prof. O. C. Morton of Great Falls as guide, and to his minute knowledge of the country, and zealous labours, the success of the undertaking is in very large measure due.

Many gentlemen in Great Falls, White Sulphur Springs and Livingston exhibited great interest in the work of the expedition, and assisted it by every means in their power. To enumerate all of those to whom the party is under obligations for many kindnesses would require more space than can be allotted to this brief notice; but special thanks are due to the Hon. Paris Gibson and Mr. W. W. Conner (Princeton '85) of Great Falls, but for whose most kind and prompt assistance at a critical period, the trip would have necessarily been abandoned.

The journey was concluded by a tour through the Yellowstone National Park, the pleasure of which was greatly enhanced by the courtesies extended to us by the officers of the army at present in charge of the Park, Captain Anderson, 6th U. S. Cavalry, Park Superintendent, and Captain Edwards and Lieutenant Pitcher of the 1st Cavalry.

The Deep River (*Ticholeptus* beds of Cope) is a Miocene lacustrine deposit, occupying a long narrow valley in central Montana, enclosed between the Great Belt and Little Belt mountain ranges. The formation has but a small geographical extent, and no indications of it were found north of the Beaver mountains, though maps have been published which show it extending as far north as the Missouri River. More thorough search might, how-

ever, reveal traces of it in this region, and reports were brought to the party, which would seem to point to its extension along the Teton River far to the north of the Missouri. In the region examined by the Princeton party the beds are quite thin, and in very marked contrast to the great development of the White River and other Miocene deposits. They lie unconformably upon a highly inclined, folded and eroded series of limestones and slates, which are presumably of Carboniferous age. The beds vary much in character, the lower strata are comparatively very hard, and similar in many respects to those of the John Day Miocene in Oregon, while the middle and upper strata are but slightly indurated sands and clays, which occasionally become much harder immediately around the enclosed fossil bones. At only two points were the fossils found at all abundantly, elsewhere they are very scanty.

The formation was first described by Cope, who originally regarded it (1878) as a subdivision of the Loup Fork, but afterwards erected it into a distinct epoch. He gives the following list of species as occurring in the Montana area: *Mastodon proavus*, *Protohippus sejunctus*, *Merycocherus montanus*, *Merychys zygomatiscus*, *M. pariongonus*, *Cyclopidius sinus*, *C. emydinus*, *Pitheciastes brevifacies*, *P. decedens*, *P. heterodon*, *Procamelus* vel *Protolabis* sp., *Blastomeryx borealis*. Professor Cope did not himself visit the Deep River beds, and in one important particular has been misled, viz., in assuming that all the species in the above list occur together and represent a single horizon. Our collections led to a very different result, and appear to show that there are at least two, and apparently three, well marked horizons in the formation, each one characterized by its own peculiar fossils.

The lower horizon crops out on the west

side of the river, and is very rich in mammals at the northern point marked "Fossils" in the map. The assemblage of forms found at this point bears a very close resemblance to the fauna of the John Day Miocene, but so far as could be judged from the hasty and imperfect examination which alone is practicable in the field, the species and, to some extent, the genera are different from those which occur in Oregon, and would seem to represent a slightly later horizon. The genera which were obtained in these lower strata are the following:

? <i>Temnocyon</i> ,	<i>Merychypus</i> ,
Ailuroid indet.,	<i>Merycocharus</i> ,
Rodent indet.,	<i>Agriocharus</i> ,
<i>Anchitherium</i> ,	? <i>Pebrotherium</i> ,
Rhinoceros indet.,	<i>Hypertragulus</i> .

The *Temnocyon* is about the size of the *T. Josephi* of Oregon. The Ailuroid is smaller than any which has yet been found in Oregon, and may represent a new genus. If not, the only genus in the above list which does not occur in the John Day formation is *Merychypus*. The supposed *Pebrotherium* is represented only by teeth, and may belong to a different but closely allied genus.

The middle horizon has a very rich fossiliferous locality at the point marked on the map "Fossils," near Rabbit Creek on the east side of Smith River. This locality consists of a number of dry water courses, which have been cut deep down into the soft beds, and in the nearly vertical walls of which the specimens were found in abundance. The following genera occur at this point:

<i>Ailurodon</i> ,	<i>Merycocharus</i> ,
<i>Anchitherium</i> ,	? <i>Leptauchenia</i> ,
<i>Chalicotherium</i> ,	<i>Cyclopidius</i> ,
<i>Merychippus</i> ,	<i>Pitheciestis</i> ,
Rhinoceros indet.,	<i>Protolabis</i> ,
<i>Merychypus</i> ,	<i>Blastomeryx</i> .

In addition there were found loose specimens of *Protohippus* and *Procamelus*, but these appear to have been washed down from the uppermost beds, and did not occur at this point *in situ*.

It will be observed that three genera, *Anchitherium*, *Merychypus* and *Merycocharus*, are common to both the middle and the lower horizons, but the species representing them are different. The species of *Anchitherium* in the middle bed is much larger than that in the lower, and has the median digit of the fore and hind foot distinctly stouter, while the lateral digits are somewhat more reduced. In nearly every respect this species approximates closely to the *A. aurelianense* of Europe. The species of *Merychypus*, which is most characteristic of the lower strata, is *M. zygomaticus* Cope, with short crowned molars, while in the middle bed this species was not found, its place being taken by species having, for the most part, more or less hypsodont teeth. Professor Cope originally referred the *M. zygomaticus* to a distinct genus, *Ticholeptus*, and there are reasons to believe that the distinction is a valid one, and that that genus should be revived. Whether the species of *Merycocharus* are equally distinct in the two beds cannot at present be decided. None were found as large as the *M. macrostegus* from the John Day.

At the top of the formation and along its eastern boundary, near the limestone foot-hills of the Little Belt Mountains, still another assemblage of mammals was found. Here the fossils are much more scanty and less well preserved than in the other localities described. Among other specimens, as yet not identified, there occur at this point the following genera: *Mastodon*, *Protohippus*, ? *Aphelops* and *Procamelus*. So far as it goes, therefore, this fauna is typically that of the Loup Fork epoch.

Professor Cope considers that the beds

on Cottonwood Creek, Oregon, which there overlie the John Day, belong to a horizon equivalent to the Deep River beds in Montana. After giving lists of the fossils collected at the two localities, he says: "The only species common to the two lists is the *Blastomeryx borealis*, a fact which indicates some important difference in the horizons, topographical or epochal. The Oregon specimens consist of teeth only, from both jaws, which are identical with those of the three crania known from Deep River." (American Naturalist, vol. XX., p. 369.) On the other hand, it may be objected to this identification that the cannon-bones of *Blastomeryx* which were obtained in the Cottonwood Creek beds by the Princeton expedition of 1889, indicate an animal of very different proportions from the extremely slender species which occurs in Montana. However, the number of known species from the Oregon beds is as yet too small to allow any satisfactory correlation between the two localities.

No fresh-water mollusca could be discovered in the Montana formation, in spite of the most careful search, and the only reptiles found were turtles, which were fairly abundant, but for the most part very badly preserved.

As it was taken for granted that the geology of the region explored had been completely worked out, and offered no other problems for solution than those regarding the fossils themselves, surveying instruments were most unfortunately left behind. The apparent segregation of the fauna, which had always been regarded as of uniform distribution throughout the formation, into three distinct horizons, was a great surprise, and it is much to be regretted that the stratigraphy could not be worked out with precision, so as to confirm or refute the conclusions drawn from the col-

lections. However, Mr. Weed, of the U. S. Geological Survey, has kindly undertaken to supply this need, and the results of his work will be awaited with much interest.

The Deep River beds are thus found to make a singularly complete transition series between the John Day and the Loup Fork epochs, but it may well be questioned whether these beds should continue to rank as a distinct formation. If we disregard the fossils which are found in the lowest horizon, which can hardly be distinguished from the typical John Day, the other two differ in very moderate degree from the Loup Fork, the presence in the middle bed of *Anchitherium*, *Cyclopidius* and *Pitheciastes* being the only noteworthy distinction. But this difference is no more marked than that between the Wind River and the Bridger proper, or between the *Titanotherium* bed and the overlying typical White River Miocene. Should the testimony of the fossils be confirmed by the stratigraphical examination, it would seem that Professor Cope's original suggestion, regarding the Deep River bed as a subdivision of the Loup Fork is, after all, the best one, though, of course, such a conclusion in no way diminishes, but rather increases the value and importance of this transitional series.

The collection gathered by the expedition includes much material of great interest, partly as indicating new and undescribed species and genera, but more especially in that many very important types, which have hitherto been known only from teeth or other fragmentary portions, are represented by nearly complete skeletons, which promise to throw very welcome light upon some obscure and disputed phylogenies.

THE GRAMPUS EXPEDITION.

By C. G. ROCKWOOD, Jr.

During the past summer the investigation of submarine temperatures in the mackerel region south of Nantucket and Martha's Vineyard under the auspices of the U. S. Fish Commission, was again carried on by Professor Libbey with the assistance of Professor Rockwood, Professor M. McNeil of Lake Forest, and Messrs. Lewis S. Mudge, S. T. Dodd, and G. L. Shearer, recent fellows and graduates of Princeton, and W. H. Dodd, '93.

The plan of procedure was much the same as in 1890, but, as the U. S. Coast Survey did not find it possible to afford the assistance of a steamer as in 1890, all the work had to be done by a sailing vessel and was therefore necessarily less in amount. However, ten lines of serial temperatures were run by the schooner Grampus, and regular meteorological observations were kept up from July 3d to

August 18th on the Nantucket New South Shoal Light ship.

The profiles of bathyisotherms obtained from the observations were in general similar to those found in previous years, except that a large body of cold water, reaching up near the surface, was found at the southern end of the lines run. As no indication of such a body of cold water had been found last summer, it at once attracted attention and succeeding trips were directed to the examination of its limits and permanency. But the lines of observations, though of usual length, about 130 miles, did not reach far enough south to determine the southern boundary and therefore a final more extended trip was planned in which the Grampus went south to latitude $38^{\circ} 00'$, making a line of 200 miles in length, and determining the width of the cold band to be about fifty miles.

The members of the party met with no serious mishaps, and returned to their homes in good health.

SUMMARIES OF PAPERS

READ BEFORE SCIENTIFIC SOCIETIES.

LEXICOGRAPHICAL GLEANINGS FROM
THE PHILOBIBLON OF RICHARD
DE BURY.

By ANDREW F. WEST.

Richard de Bury finished his Philobiblon at Auckland, near Durham, on January 24th, 1345. He tells us in the Prologue that his *tractatus parvulinus* is written *stylo quidem levissimo modernorum*—a statement which points to an employment, at least in part, of the more careless contemporary Latin as against a set scholastic style. The miscellaneous learning in which he fairly revels and his curiosity regarding the remote by-ways of knowledge, coupled with his propensity to make

a talismanic display of sounding terms and recondite words, have resulted in leaving many a *crux* for interpreters. It is the purpose of this note to set forth and explain (1) such of these as have not yet found their way into dictionaries; (2) and such others as are used in a different sense than has been recorded; (3) with still others which supplement solitary or rare instances already known.

I. WORDS NOT YET IN DICTIONARIES.

anthropospathos = the figure *anthropospathos*.

archiphilosophus = arch-philosopher.

aux = apogee, the "Auge" of older English.

canonium = rule, test.

comprehensor = the obtainer of a prize, the Christian in heaven.

euxeria = health of body.

gezahar = the "dragon" of Arabic astronomy, the nodes.

geologia = the study of law, the science of earthly things.

hieraphilosophus = holy philosopher.

Logostilios = the book *Logostilios* (Λόγος τέλειος).

pamfletus = pamphlet.

Philobiblon = the book *Philobiblon*.

polychronitudo = longevity.

pseudoversificus = a pseudo-versifier.

superlunaris = superlunary, the antithesis in Arabic astronomy to *sublunaris*.

II. WORDS USED IN A SENSE NOT RECORDED IN DICTIONARIES.

architectonicus = a master-builder.

caritativus = compassionate.

inculpandus = blameless.

innisus = dependence, reliance.

lanista = a ruffian.

lilium = the pure white margin of a manuscript.

scurra = a hireling soldier.

tabulatio = index, table of contents, summary.

III. WORDS SUPPLEMENTING RARE OR SOLITARY INSTANCES IN DICTIONARIES.

antonomastice = antonomastically, *par excellence*.

assub = a falling star, a meteor.

cervicosus = stiff-necked.

diasynthetica = syntax.

discophorus = a bowl-bearer.

Elefuga = the *Pons Asinorum*, the fifth proposition in Euclid.

impedibilis = hindered, closed.

inattigibilis = unattainable.

incomprehensibilis = incomprehensible.

ostensivus = demonstrative, apodictic.

seminiverbius = a babbler, a gassy talker.

sublunaris = sublunary.

synderesis = συντήρησις, man's moral nature.

vespillo = a free-booter, a marauder.

[Abstract of paper read before the American Philological Association, at Princeton, July 8, 1891.]

ENGLISH LEXICOGRAPHY.

By T. W. HUNT.

After calling attention to the recent rapid development in the direction of English Philology and, especially, within the sphere of Lexicography, the subject was presented in its three historical periods—

First English—449–1154 A. D.

Middle English—1154–1500 A. D.

Modern English—1500–1891 A. D.

In the first era, special emphasis was laid upon the labor of Spelman, Sumner, Bosworth and Grein; the edition of Bosworth, known as the Bosworth-Toller edition, being an elaborate revision of the original. In the second period, the work of Stratmann, Maetzner, Skeat, Mayhew, Morris, and others was emphasized, and due indebtedness expressed to the scholarly editions of such bodies as the Early English Text Society, and The Society of Antiquaries.

The Modern Period was presented under two distinct eras, the first extending from 1500 to 1700 A. D. and the second, from the latter date to the present.

As to the first of these eras, it was noted that special pains were taken to show the relationship of English to other languages, the earlier lexicons being bi-lingual and tri-lingual, as seen in Elyot, Baret, Rider and Minsheu.

A further design is seen in the effort to give technical and special compends, as in Cowell, Spelman, Phillip, and Skinner, thus anticipating the later lexical method.

The Modern Period Proper opened with Bailey's Dictionary, 1721. In 1755, Doctor Johnson's appeared, followed in due succession, by Walker, Richardson, Latham, and others. Special attention was called to the labors of Webster, Stormonth and Worcester, and to the great lexical undertakings of the present—The New English Dictionary, and The Century Dictionary.

By way of inference and suggestion, Professor Hunt discussed, in closing, the indebtedness of all later lexicographers to the earlier; the legitimate domain of lexicography, and the true relation of lexical work to literary work.

[Outline of a paper read at the American Philological Association, in Princeton, July, 1891, and published in the October number of the *New Englander and Yale Review*.]

SUMMARY OF PAPERS PUBLISHED.

OCEAN TEMPERATURES.

By W. F. MAGIE.

In the Bulletin of the United States Fish Commission, vol. IX., for 1889, which has just been published, appears a report by Professor William Libbey, Jr., of the results obtained by him during the summer of that year in his investigation of the physical characteristics of the waters off the southern coast of New England. Occasional notes of these investigations, which are still in progress, and preliminary reports on the results obtained, have appeared in this BULLETIN, but the present is the first opportunity which has been given to examine the results in detail.

The purpose of the investigation may best be learned from the following statement in Professor Libbey's report:

"It is believed that in the seasonal variations of the hydro-isothermal lines will be found the key to explain the migrations and geographical distribution of our important food species [of fish] as well as of the food upon which they subsist, as both depend upon the temperature variations which determine the changes that occur in their location. It may also happen that while the changes in position of these areas of equal temperature will differ in succeeding seasons, they will, however,

stand in some essential relation with the general meteorological conditions upon the land which are under constant observation and discussion." To further this research the Commissioner of Fisheries placed at Professor Libbey's disposal the Commission's schooner, the *Grampus*, and had it properly fitted with sounding lines, hoisting engine, deep sea and other thermometers, and a complete set of instruments for meteorological observations.

The portion of the ocean selected for study was that lying south of Nantucket, Martha's Vineyard and Rhode Island, a region where the Gulf Stream begins to lose the sharp boundary which characterizes it in the earlier parts of its course, and where the commingling of it with the cold Labrador current produces irregular and remarkable differences of temperature. In this region, extending between Lat. $39^{\circ} 10'$ and $41^{\circ} 20'$, and between Long. $70^{\circ} 00'$ and $71^{\circ} 30'$, 136 stations were occupied. As far as possible the meridians on which these stations were located were $10'$ apart, and the stations were ten miles apart on those meridians. At these stations measurements were made of the depth of the ocean when it was less than 500 fathoms, of the specific gravity of the surface-water and of the water at different depths, and of the temperatures of

the water at the depths of 5, 10, 15, 20, 25, 30, 40, 50, 75, 100, 150, 200, 250, 300, 400, 500 fathoms. These observations are collected in tables occupying 15 pages of the report. They plainly enough show the irregular distribution of the warm and cold water due to the meeting of the two currents before mentioned. Upon these data is based a series of nine charts, giving the isothermal curves for 70°, 65°, 60° and 50°, in the meridians along which the various courses were run. An examination of these charts shows clearly the way in which the warm waters of the Gulf Stream spread out in separate bands on the surface as they proceed to the eastward, and the effect of long-continued southerly winds is seen in the unusual proximity of these bands to the coast. The curve of 50° is very strongly re-entrant, returning from a point distant 120 miles from the coast almost to the edge of the continental platform. The observations are not sufficient to decide whether this distribution of a great mass of warm water under a sheet of colder water is due to a mechanical intrusion of the Labrador current into the Gulf Stream, or to the greater salinity and consequent greater specific gravity of the Gulf Stream water. The presence of this warm water along the edge of the continental platform is probably the reason, according to Professor Libbey, that that part of the ocean bed is so rich in marine life.

The report further contains a set of 25 tables, giving hourly meteorological observations for the days on which ocean temperatures were measured. Annexed to these are 25 plates, giving the air temperature curves plotted from the observations on the Grampus compared with the curves obtained from the observations of the Signal Service made on those days at New York and Boston. The curves of the air and the surface-water temperatures taken

on the Grampus are also compared on the same plates. These curves show general similarities, but no close connection can be shown between the land and the water temperatures, and no conclusions are drawn.

Professor Libbey was aided in his work by Professors Rockwood and Magie of Princeton, and Professor McNeill of Lake Forest.

Appended to the main report is a short report by Professor Magie on his measurements of atmospheric electricity, an account of which has already appeared in this BULLETIN; and a report by Professor Brooks, of Johns Hopkins University, on the zoological collections made by the observers on the Grampus.

THE OSTEOLOGY OF POEBROTHERIUM.

By W. B. SCOTT.

This interesting genus stands about midway in the line of descent of the camels and llamas and apparently represents the common ancestor of both of these series. The description is founded upon a nearly complete skeleton which was discovered by the Princeton expedition of 1890 in the White River beds of Dakota.

The skull is very much like that of the llama, but decidedly more primitive and with unreduced dentition. The neck is very long, but relatively shorter than in the modern forms; the odontoid process of the axis is peg-like and not spout-shaped. The other vertebrae are more slender and delicate in construction than those of the llama, and beginnings of the episphenial processes are seen on the lumbar. The scapula is much like that of the llama. The humerus is very different from that of the existing *Camelidae*; the external tuberosity is very large and extends across nearly the whole anterior

face of the bone; the bicipital groove is single and the bicipital tubercle a minute rudiment. The proximal end of the humerus is therefore constructed almost exactly as in *Meshippus*, the White River horse. The ulna and radius are coössified. A trapezium is present in the carpus. The median metacarpals are very long and slender, and are not coalesced; the lateral ones are minute tubercles. The phalanges are long and slender and the unguals resemble those of the antelopes.

The hind limb is very like that of the modern genera, but relatively more slender. The median metatarsals are longer and stouter than the corresponding metacarpals and like them are free. In most specimens the rudimentary second metatarsal has coalesced with the third. The meso- and ectocuneiforms are united, the other tarsals free. The line of descent of the *Camelidæ* would appear to be the following: In the Wasatch, *Pantolestes*; in the Bridger, *Homacodon*; in the Uinta, *Leptotragulus*; in the White River, *Poebrotherium*; in the lower Loup Fork, *Protolabis*, and in the upper Loup Fork, *Procamelus*, one species of which, *P. occidentalis* is regarded as the fore-runner of the llamas, while *P. angustidens* seems to stand in the same relation to the camels.

(Abstract of a paper in the Journal of Morphology, Vol. V, pp. 1-78, Pl. 1-111.)

A PHOENICIAN BOWL IN THE METROPOLITAN MUSEUM.

By ALLAN MARQUAND.

This bowl belongs to the celebrated group of objects known as the Treasures of Curium, discovered in the island of Cyprus by General di Cesnola. It measures six inches in diameter and an inch and a half in depth and is so fractured, bent and corroded that the design is made out with great difficulty. Originally of

silver it has become, through the action of the soil, transmuted into chloride of silver.

The design consists of a central medallion on which is engraved the goddess Isis suckling Horus, and around which are four concentric figured zones. The first zone is a pastoral scene representing a man with his horses, some walking, others grazing or suckling colts; this second zone figures apparently a funeral banquet in honor of a departed friend; on the third are pictured worship and sacrifices; and on the fourth an excursion from the town to a sacred grove, where homage is paid to the gods.

The bowl seems to have been a pious offering for the soul of a departed one and for his family. We may interpret the design in the light of Egyptian figured designs and inscriptions. The central medallion has then a meaning analogous to the inscription upon the libation vase of Osor-Ur (*Records of the Past*, vol. XII., p. 79) which reads: "The resident of the West hath established thy person among the sages of the divine lower region; he giveth stability to thy body among those who repose and causeth thy soul not to distance itself from thee. Isis, divine mother, offereth thee her breast, and thou hast by her the abundance of life." The successive zones of figured ornament may be considered, according to Egyptian formulas, as prayers that the departed may receive all manner of good things. As upon the stele of Iritisen (*Records of the Past*, vol. X., p. 3) we read a prayer to Osiris to give a "funeral meal of bread and liquor, thousands of loaves, liquors, oxen, geese, all good and pure things, to the pious Iritisen, and to his pious wife Hapu, who loves him," so here we may read similar prayers for the hero and his wife. And upon the final zone the piety of the departed is recorded, as upon the stele of Iritisen, "I know the mystery of

the divine word, the ordinances of the religious feasts, every rite of which they are fraught. I never strayed from them."

Though hastily executed the design upon this bowl is extremely elaborate and significant as well as decorative.

[Abstract of a paper in the *American Journal of Archaeology*, March-June, 1891.]

NOTES ON ROMAN ARTISTS. TOMBS OF THE POPES, BY VASSALLECTUS AND PETRUS ODERISI.

By A. L. FROTHINGHAM, JR.

Only a few Papal tombs remain from the middle ages in good preservation. Of these two of the most magnificent have remained inedited, and are here published and their history related. Viterbo was a favorite residence of the Popes during the XIII century, and was next to Rome, the largest city in the Papal states. Four popes were buried there at that time,—Alexander IV, Clement IV, Hadrian V and John XXI. The remaining monuments are those of Clement IV (1268) and Hadrian V (1276), now in the church of S. Francesco. The second of these monuments is the better preserved. It consists of a double oblong basement upon which rests a sarcophagus with pentagonal lid upon the front inclination of which lies the colossal figure of Pope Hadrian in Papal robes and single tiara. Above this solid monument in three receding stories rises a canopy composed of two twisted marble columns in front supporting a pointed trefoil arch, whose gable reaches to the church wall and rests on engaged pilasters. The total height of the monument is over twenty feet. The style is that of the Roman school which is called Cosmatesque from a prominent artist, Cosmas, whose works were best known at the time when the school was first studied. The decoration, as is usual with the school, consists of brilliant and

harmonious patterns of mosaic made of cubes of different colored marbles sometimes surrounding slabs of porphyry. The basements, sarcophagus, columns and colonnettes, arcade and gable are inlaid with this decoration, which has never been seen to greater perfection than in this monument. The author is unknown but circumstances point to the most brilliant artist of this period, Vassallectus. That he worked in this church of S. Francesco at Viterbo is proved by his signature on a tabernacle in the apse: M. VASSALLECTVS ME FECIT. It is improbable that he should have come to Viterbo from Rome for so insignificant a work as this tabernacle, while he is the only artist who appears capable of having executed this work in 1276: his fame made him the one to whom it would naturally have been entrusted. His best known remaining works are the Cloister of St. John Lateran and the episcopal throne at Anagni, the former executed about 1230 the latter in 1265.

The monument of Clement IV executed shortly after 1268 and finished in 1271 has been badly damaged and the canopy lies in fragments. Originally it was of exactly the same form as Hadrian's tomb, except for some blind pointed arcades on the base. Its decoration, however, and the style of the pope's reclining figure show a less masterly hand. While Hadrian's statue is dignified, with rich and significant drapery and a portrait-like face full of repose, that of Clement is rude and heavy in its forms and with a face devoid of expression. Its sculptor was no better and no worse than others of his time; while Vassallectus was only equalled by his contemporary Niccola Pisano to whom the revival of sculpture in Italy is commonly ascribed.

A third monument, in which were buried some members of the great Vico family

of Rome also remains in part, next to Clement's tomb: here also the canopy has been destroyed and there is even no reclining figure. There are sufficient indications of style to lead us to ascribe both to one artist. What his name was has not been known hitherto to students, but it is disclosed by a copy of the original inscription in Clement's tomb, now destroyed, made in the XVIII century by Papebroch. He was *Petrus Oderisi*, Peter the son of Oderisius, an artist hitherto unknown to those who have studied the Roman school, for he cannot be identified with certainty with any one of the several Peters of whom we have records. The only probable connection is with the *Petrus* and the *Oderisius* of Rome who worked in Westminster Abbey in London during 1269, executing the mosaic pavement in the choir, the shrine of Edward the Confessor and the tomb of Henry II.

The importance of these works is not merely intrinsic: it is also historical. They are the earliest in date of their kind as well as the most magnificent and show conclusively that we owe to the Roman school the invention of this type of sepulchral monument which became so popular, with variations, in various parts of Italy and was adopted by the Pisan school. On the basis of Arnolfo's tomb of Cardinal de Braye, at Orvieto, executed a number of years after these monuments, the invention of the type was attributed to the Tuscans, but is now proved to be exclusively Roman.

[Abstract of a paper in the *American Journal of Archaeology*, March-June, 1891.]

THE ETHICAL ANTECEDENTS OF THE ENGLISH DRAMA.

By T. W. HUNT.

The purpose of this paper is to show the historical connection, literary and

ethical, between the Pre-Elizabethan and the Elizabethan Drama.

After calling attention to the natural origin of dramatic representation in the habit and mental instincts of the race, the discussion lays special stress upon the attitude of the Greek and Latin fathers and the early church to the histrionic art, as ecclesiastics made an honest effort to control a literary movement which they could not check had they desired it. The governing influence of the Norman Conquest upon the developing drama is shown as, also, the natural transition from the old plays of Hilarius, the monk, to the perfected examples of subsequent eras.

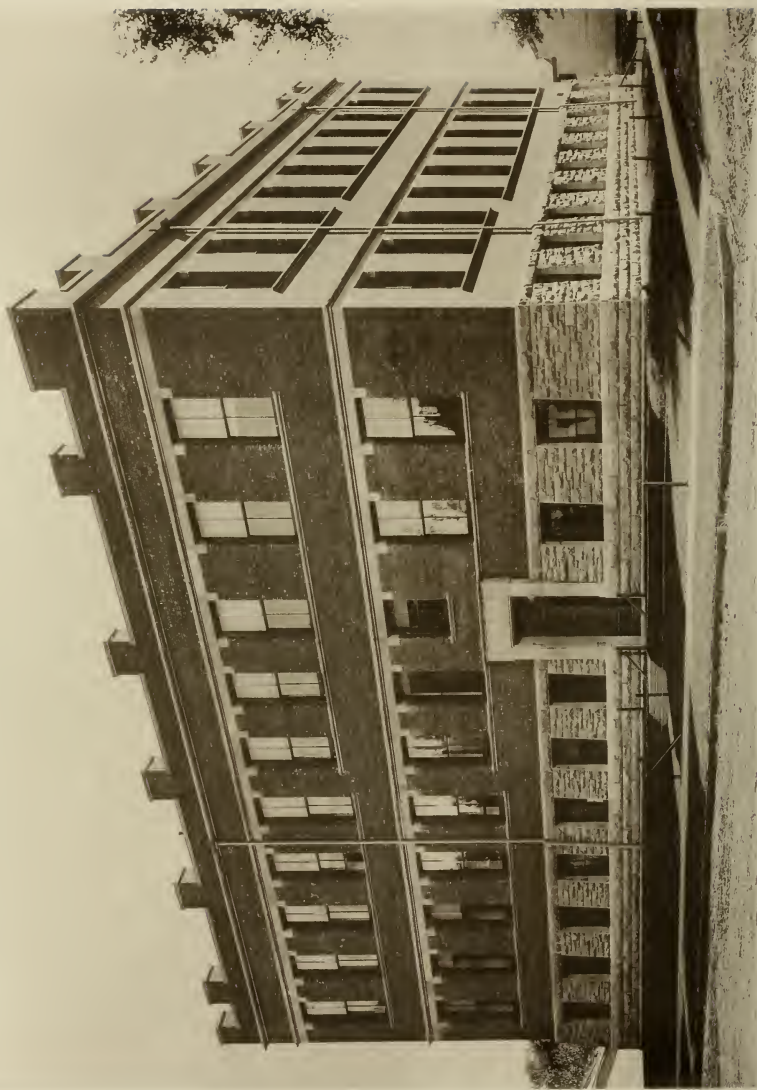
Under the three-fold division of Mysteries or Miracle Plays, Moralities, Interludes and Chronicle Plays, the historical sequence is traced to the fully developed Elizabethan forms, and the sixteenth century of scenic art in England is thus connected with the preceding centuries back to the Conquest in 1066. After a brief reference to the earliest examples of Tragedy and Comedy in England, emphasis is laid, in closing the paper, upon those literary and ethical elements that lie at the basis of all genuine dramatic art and the importance urged of maintaining the connection between the English stage and the best expression of the English intellect and conscience.

[Outline of a paper published in the July number of *The Pres. and Ref'd Review*.]

During the summer, Professor Hunt has published the following additional papers:

"Plain Preaching," in July No. of *Bibliotheca Sacra*.

"Liberty of Thought and its Limitations," *New York Observer*, August.



THE NEW CHEMICAL LABORATORY.

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. IV.

FEBRUARY, 1892.

No. 1.

THE NEW CHEMICAL LABORATORY AT PRINCETON.

At the beginning of the present College year all of the work of the Department of Analytical Chemistry and Mineralogy was transferred from the School of Science building to the new Chemical Laboratory, which has just been erected by the residuary legatees of Mr. John C. Green, to whose liberality the college owes so much.

This fine and convenient building, of which a view is given in this number of the BULLETIN, was finished just in time to relieve the crowded condition of the rooms in the School of Science, consequent on the rapid growth of the Scientific Department during the last few years.

The Laboratory has entrances both on Nassau and Washington streets, the main entrance being on Nassau street. It is built in the most substantial manner, after designs by the well-known architect, Mr. Richard M. Hunt, of New York, from plans furnished by Prof. Cornwall. The basement walls are of light-colored sandstone, and the rest of the building is of selected red brick. The construction throughout is of the most approved fire-proof style; the walls being furred with hollow brick, all partitions of brick, and the floor beams of iron. The spaces between these beams are filled with brick arches, carrying a solid layer of concrete, on which rest the wood floors. The ceilings in the upper story are of perforated

sheet iron suspended from the roof trusses and carrying the plaster. The floor of the basement is of smooth cement and fine flint concrete, except in the halls and the cloak-room, which are tiled. The floors of the upper stories are of yellow pine, and the rest of the wood work, including wainscoting and doors, is of ash.

The Laboratory will accommodate about three times as many students as the one formerly used, and while the plans were made with a view to the most advantageous use of all the room afforded by the site, yet it is believed that few, if any, chemical laboratories allow more space for each student. A more detailed account of the laboratories, lecture-rooms and desks in the building will appear in a future number of the BULLETIN, but a brief description of the more important features may here be given. The Nassau street front, which is in the foreground of the view, measures 101 feet 3 inches in length; that on Washington street, shown on the right in the view, 108 feet. The wing on Nassau street is 42 feet wide, and the main wing on Washington street is 58 feet wide. The height of the building is 53 feet. On the top floor are the principal laboratories for students, together with private laboratories for the professors and assistants, balance room, reading room and sulphuretted hydrogen room. The larger of the students' laboratories is 71 feet 10 inches long and 50 feet 2 inches wide, the ceiling being 16 feet high. This laboratory is lighted by a

central skylight 38 feet long and 12 feet wide, besides the numerous windows on both sides and at one end. It is provided with desks for 82 students, each having his own desk with closets and drawers that can be locked. When occasion arises, fourteen more desks can be put in this laboratory. Hoods along both sides furnish facilities for processes requiring the use of strong acids or other reagents likely to cause offensive fumes, and each desk is provided with water, gas and suction for filtering apparatus. The smaller laboratory for students on this floor has forty-two separate desks, also provided with closets and drawers.

On the next floor are two lecture rooms, a mineral cabinet, apparatus rooms, a laboratory for chemical physics, a small laboratory for advanced students, and the professor's private laboratory. The largest lecture room is 50 feet 2 inches long and 38 feet 2 inches wide, and has seats for one hundred and sixty-five students; the smaller lecture room is 34 feet square, with seats for sixty students, and is used by special classes. The ceilings of this story are 15 feet 6 inches high.

In the basement are the janitor's room, large store-rooms, assay laboratory, gas analysis room, and a fine large room which can be used for laboratory experiments in technical chemistry. There is also a very convenient cloak-room, containing 120 lockers, or rather small wardrobes, in which students can hang their hats and overcoats.

In the boiler house near by, which contains the boilers connected with the steam-heating apparatus for a number of the college buildings, is a steam air-pump, which furnishes the suction for the filtering apparatus in the various laboratories.

Especial attention has been paid to securing good light and ventilation, by means of as many windows and flues as the construction of the building would allow.

The efficiency of the department has been greatly increased by the accommodations afforded by this new laboratory, which will also permit the College to offer instruction in experimental and analytical chemistry to many students who could not otherwise have added this branch to their course.

THE HON. SAMUEL WOODRUFF, TRUSTEE OF PRINCETON COLLEGE.

The Hon. Samuel Woodruff, of His Majesty's Council for the province of New Jersey, was a Trustee of Princeton College from its incorporation in the year 1749 until his death in 1768, and during that time he filled no inconsiderable space in its annals. His name appears next after that of President Aaron Burr and before the names of Jonathan Sergeant, Elihu Spencer and Caleb Smith in the committee to negotiate with the inhabitants of Princeton for the site of the College; also in the committee to arrange for the building of Nassau Hall and the President's House; and thereafter in various committees to confer with incoming Presidents, to adjust the relations of the College to the village church, to provide for a due representation of Old and New Side Presbyterians in the Faculty, and generally to take financial measures for replenishing the treasury. As one of the founders and patrons of the College during its early trials, he deserves to be recalled from the obscurity into which he has been thrown by the more brilliant names and events of the Revolutionary era. With the old colonial régime to which he belonged, he seems to have been simply ignored and forgotten by the party since dominant in our history.

Samuel Woodruff was descended from John Woodruff, who left Yorkshire, England, under the disastrous reign of Charles I. and came to the colony of Massachusetts Bay in 1638. Some indications point to

a connection of his family with that of the Earl of Northumberland who took the Presbyterian side in the civil wars.* Be this as it may, it is quite probable that like other gentlemen in the train of Governor Winthrop, he was seeking better fortunes as well as religious freedom in the New England beyond the seas. Finding good land scarce and the Puritan rule as there and then maintained too strict for his conscience and comfort, he withdrew with a like-minded company who sailed out from Lynn in their own vessel, as in another "Mayflower," around Cape Cod, down past the stormy Point Judith, to a well chosen site on the Eastern Shore of Long Island, which they named Southampton, in remembrance of the sea-port whence they embarked for America. Their land-title as derived from the Earl of Stirling having been re-inforced by a humane treaty with the Peconic Indians, this first colony of Englishmen on New York soil became founded in natural as well as legal justice. It was not long be-

fore it appeared how they had differed from their Massachusetts brethren on the question of letting the tares and wheat grow together until the judgment. They did not require every townsman to be a church member,—so displeasing their much-loved pastor, the Rev. Abraham Pierson, by their liberal terms of citizenship that he departed from them to join the straiter sect of New Haven. With continued consistency, they afterwards exchanged the Congregational for the Presbyterian type of English Puritanism by connecting themselves with the distant Presbytery of Philadelphia; and at the same time their kinsmen at Elizabethtown readily united under that Presbytery with the Scottish Covenanters who had been fleeing into East Jersey from the persecution of James II. It was thus that the seeds were sown of that form of religious culture which now has its flower in the catholic orthodoxy of Princeton University.†

* The question is more curious than important. It is known that the same political troubles which drove some of the Yorkshire gentry to New England about the year 1638 soon afterwards impelled the great Presbyterian Earl of Northumberland, and his party in the Long Parliament, to seek for a New England home. (Winthrop's Journal, II, 7, 31, 74. Bancroft's Hist. U. S., I, 383-385, 411-12. Neal's Puritans, 621-2. Histories of Clarendon, Italian, Von Ranke, Green.) It is also known that Lady Elizabeth Percy, elder sister and co-heiress of the preceding Earl had been married to Richard Woodruffe, of Wooley, in the county of York, and that their grandson Charles Woodruffe, dying shortly before John Woodruff emigrated to America, was succeeded by no legal representatives in England. The line broken in the old world must be traced in the new.—Notes and Queries, Fifth Series, Vol. VIII, 89, 236. Sixth Series, Vol. VII, 127, 396. Seventh Series, Vol. VII, 208, 292, 437.

† The above historical statements are supported by the following authorities: Winthrop's Journal, 204; Mather's Magnalia, III, p. 389; Hutchinson's Hist. of Mass., I, 19, 88; Lechford's News from New England, A. D. 1639; Bradford's New England Chronology, p. 51; Adams' Hist. of New England, pp. 53, 75; Bancroft's Hist. of U. S., Vol. I, pp. 355, 406, 463; Vol. II, 410-13; Palfrey's Hist. of New England, I, pp. 345, 347, 604; II, p. 590; Trumbull's Hist. of Conn., I, pp. 143, 144; Thompson's Hist. of Long Island, I, p. 536; Prime's Hist. of Churches on L. I.; Sprague's Annals of Amer. Pulpit, I, p. 116; Address at Centennial Celebration at Southampton, L. I.; Briggs' American Presbyterianism, 177, 178; Stearns' Historical Discourses, First Church, Newark, pp. 13, 15; Hatfield's Hist. of Elizabethtown; Hodges' Hist. of Presbyterian Church, pp. 35, 37, 55, 56; Whitehead's East Jersey, pp. 58, 59, 188, 228.

East Jersey became an asylum for fugitives from New England intolerance as well as Old England oppression, thus receiving not only Puritans but Covenanters, Hollanders and Huguenots, with

strong affinities for Presbyterianism and Episcopacy rather than Congregationalism. All these elements entered into the making of Princeton College, as the roll of trustees during the colonial period shows in such *New England* names as Belcher, Pemberton, Dickinson, Burr, Pierson, Sergeant, Woodruff, Spencer, Caleb Smith, Treat, Brainerd, Ogden, Green, Hazard, Edwards, Cowell; in such *Scotch* names as Hamilton, Livingston, Hude, Johnston, Tennent, Blair, Finley, McKnight, Cunningham, Rodgers, Bostwick, Beatty, Kirkpatrick, Ewing, McWhorter, Arthur, Robert Smith, Boyd, Caldwell; and in such *Dutch and French* names as Leydt, Frelinghuysen, De Roude, Boudinot, Bayard, Van Arsdale. To these should be added the *English* names of Leonard, Stockton, Kinsey, Shippen, Kedman, some of whom had passed from the Society of Friends into the Presbyterian Church; and the *Welsh* names of Johns, Davies and Snowden, who had received Presbyterian training. The Episcopalian element also was occasionally represented in the Trusteeship. The first charter had been procured by an enlightened churchman, John Hamilton, Esq., acting Governor of the province. The second charter, as drawn by Gov. Belcher, included among the incorporators members of the King's Council who were Episcopians, and without whose consent no charter would have been granted. The first treasurer of the college was also treasurer of the province, the Hon. Andrew Johnston, a liberal-minded Episcopalian. The Bishop of Durham contributed to the funds, and urged that the college should have the countenance of the Archbishop of Canterbury. In fact, it was largely aided by means of benefactions obtained through the influence of the Countess of Huntingdon, from churchmen, as well as dissenters in Great Britain and Ireland.—See Life and Times of Lady Huntingdon, Vol. I, pp. 140-2. Tyerman's Life of Whitefield, Vol. II, pp. 555. Belcher Papers, N. J. Archives, VII, pp. 84, 85; VI, p. 213. MS. Diary of Davies. President Green's Notes, pp. 338, 304, 272, 288. Sprague's Annals, Vol. V. (Episcop.), p. 103. Webster's Hist. of Pres. Church, pp. 258-60, 555, 556.

John Woodruff died at Southampton in 1670. Of his life there little has been learned, but that little bears upon the present inquiry. His daughter Anne Woodruff had been married to Robert Wooley, one of the planters of Elizabethtown; another daughter, Elizabeth, had become the wife of Ralph (or Richard) Dayton, also of an Elizabethtown family; and concerning his son his will, dated May 4, 1670, has the following mention: "I give unto my Eldest son John Woodruff of Elizabethtown one half Crowne piece of Money in full of all portions and Patrimony whatsoever, to be expected from me, or out of any part of my Estate." Events explain this legal provision to mean that John Woodruff, Jr., had already received his portion and patrimony on leaving Southampton for his new home in the Jersey wilderness. He brought with him his young wife Mary, two men-servants and a maid-servant, and acquired a homestead and outlying plantations amounting to more than a thousand acres, still known as Woodruff's Farms. Next to Governor Carteret he appears as the largest landholder of the township. In the little growing settlement of sixty families he took the leading parts of military ensign, constable, High Sheriff, and at length Judge of the Common Pleas, when such offices meant more than they could now. All his children were born in Elizabethtown.* His eldest son probably was John Woodruff the Third, a Burgess in the Colonial legislature, whose wife is still commemorated in the church-

yard by an ancient gravestone bearing the conventional skull and hour-glass with this inscription:

Here Lyeth y^e
Body of M^{rs}. Sarah
Woodruff. Wife
of John Woodruff;
Who departed this
Life 2 of June 1727
in y^e 62^d Year of her Age.

Another son of the planter was Joseph Woodruff, who figured as defendant in a famous test suit of the heirs of Sir George Carteret, which involved the tenure of much Elizabethtown property and, after long pending in the Provincial Council before it could be appealed to the English Court, was at length summarily settled by the American Revolution. His son, Joseph Woodruff the Second, was a distinguished elder of the church, whose Christian graces are rehearsed on a somewhat ornate tombstone in the following terms:

Here is interred what was
Mortal of Mr. Joseph
Woodruff who Died Septem^r
y^e 25th 1746 in y^e 72 year
of his Age.

Under these clods in dust and ruin lye
Remains of Meekness, Kindness, Piety,
To be revived when Christ in Glory comes
To raise his Saints and call them home.

The son of this Joseph and grandson of the first ancestor is the subject of the present sketch.

The information which has been gathered in reference to Samuel Woodruff, though scanty, is exact and significant.†

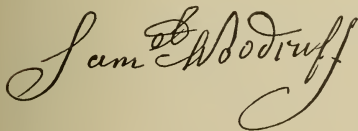
* From this ancestor are descended the Woodruffs of New Jersey as distinguished from those of Connecticut and New York. They have been a religious race, baptized with Scripture names, and old Elizabethtown surnames in endless complexity of kinship. To the Revolutionary army they contributed more than thirty persons, including nine commissioned officers, and have since risen to distinction in various branches of the public service. In the college they have been well represented throughout its history, by such graduates as Rev. Benjamin Woodruff, son of the Trustees; Hon. George Whitefield Woodruff, Attorney-General of Georgia; Hon. Aaron Dickinson Woodruff, Attorney-General of New Jersey; Lieut. Abner Woodruff, U. S. N.; and others of later date. The first known bequest to the college came from Charles Woodruff by his Will, proved April 19, 1751, with Aaron Burr as witness: "I give and bequeath fifteen pounds in cur-

rent money of this province to the Trustees of the New Jersey College, for the use of the said college, and for no other use whatsoever." The codicil affords a glimpse of emancipation a hundred and forty years ago: "I give my negro man, Caesar, his freedom, upon condition that he can get any body to be his security according to law."—State Records at Trenton.

† Besides consulting the New Jersey Archives and other publications of the Historical Society; the Standard Histories of N. J., by Smith, Whitehead & Mulford; of Elizabethtown by Murray and Hatfield; of the College, by Presidents Green and Maclean; of Princeton and its Institutions, by Hageman—the writer has had access to public records and legal documents through the kindness of the Hon. Thomas N. McCarter, John E. Dusenbury, Esq., Surrogate of Essex Co.; Alexander H. Tickley, Assistant Sec'y of State, and Adj.-Gen. William S. Stryker. He is

It will be no difficult exercise of the historic faculty to reconstruct his social environment and estimate his private character and public services. Born in 1700 and dying in 1768 he lived through the most formative period of the College and the country. At a time when Elizabethtown was still the capital of the Jerseys and shared largely in the foreign commerce of New York, he became an eminent merchant, with his ships sailing to the West Indies and to Europe. "Mr. Woodruff," says the chronicler, "having a vessel going to Madeira, Gov. Belcher desires him to import for his use three pipes of Madeira wine and a quarter-cask of Malmsey."* Whatever might now be thought of such an invoice, he acquired both wealth and influence in a community which measured character by religious standards. For many years he was president of the church trustees, as well as a leading elder in the synod during the Old and New Side controversy. His hospitable mansion became a home for the ministers of his day, among whom were the accomplished Pemberton, the learned Dickinson, the zealous Tennents and the eloquent Whitefield. "On the 8th of November, 1749," writes Hatfield, the historian of Elizabethtown, "Elihu Spencer visited his kinsman John Brainerd and found him enjoying the hospitality of Mr. Samuel Woodruff. Two or three days

they spent very lovingly together." The Brainerds were entertained by him only less often than by Justice Stockton at Princeton. In other relations of life his townsmen and friends represented the best elements in the colony. John Van Brugh Livingston, of the Livingston Manor, a graduate of Yale College, and an influential merchant who had retired from New York to Elizabethtown, sat with him in the King's Council as well as in the Trusteeship of the College. William Peartree Smith, another Yale graduate and an accomplished scholar and distinguished civilian, shared the same public offices and became connected with him by family ties.† Among his younger associates was Elias Boudinot, destined to become President of the first Congress, an author and a philanthropist; also that scholar and statesman Richard Stockton, who had been a student at Elizabethtown and there met and courted Annis Boudinot, the mistress of Morven, who gave it its poetical name.‡ To these should be added Hon. Robert Ogden, Gen. Elias Dayton, and Gov. William Livingston, men prominent in both the colonial and revolutionary history of the State. But the chief figure then upon the stage was his special friend Jonathan Belcher, a graduate of Harvard and a prosperous merchant in Boston, who had been received with special favor by Sophia Dorothea, mother of George II., and appointed Governor of the colonies of Massachusetts and New Hamp-



also much indebted to Ernest L. Myer, Esq., City Surveyor of Elizabeth, for accurate information concerning the estate and residence of Samuel Woodruff, and especially for the engraving of his autograph, which accompanies this sketch.

* Analytical Index of Colonial Documents in the State Paper Office at London. Edited by Whitehead.

† Peartree Smith and Rev. Benjamin Woodruff married sisters of Capt. Bryant, of Amboy, a family of great refinement. Judge Elisha Boudinot, brother of Elias, married into the same family. Both Peartree Smith and Elias Boudinot were near neighbors of Samuel Woodruff, lived in houses which he had sold or let to them, and were appointed guardians of his grandchildren by the will of his son Joseph Woodruff.

‡ This manorial estate originated in a grant from William Penn of five thousand and five hundred acres, embracing the present grounds of the College and village of Princeton. The name of Morven was taken from the scene of Ossian's poems, which were much admired and discussed in the literary circles of the last century. It signifies a *ridge of hills*, and was applied to a region of wild and varied beauty on the northwest coast of Scotland.

shire, but being driven from office by popular intolerance, was then vindicated at Court and re-appointed to the vacant chair of New Jersey. Perhaps it was not strange that his New England friends would not have a governor over them who wanted a fixed salary for the office, while he chose to set up his own "coach-and-four" and thoughtlessly remarked that he "drank half a bottle of old Madeira a day," besides indulging a "taste for malt drink." The gentlefolk of Elizabethtown seem to have had less difficulty in reconciling his "elegant style of living" with Christian virtues when they found that he had driven that coach-and-four twenty miles to hear Tennent preach and placed Brainerd and Whitefield as honored guests at that sumptuous table. They may even have forgiven him the Madeira and the Malmsey after they learned what Whitefield wrote back to Lady Huntingdon, the patroness of their young college:

"I am staying at Governor Belcher's, who sends your ladyship his cordial respects. His outward man decays, but the inward man is renewed day by day. I think he ripens for heaven apace. Last week was the Commencement of the New Jersey College, at which the President and Trustees were pleased to present me with the degree of A.M."*

It was a state of society which has been quite effaced and hidden from the view of our more democratic times. Between the extremes of Northern and Southern culture, it laid stress upon forms and titles and costumes, while insisting upon the claims of virtue and piety. There was in it a touch of English gentility over the harshness of the Puritan, the strictness of the Covenanter, the staidness of the Hollander, the primness of the Quaker, the grace of the Huguenot, and the gaiety of the Cavalier. At one time, indeed, all these elements seem to have been fused together under the eloquence of that Presbyterian clergyman of the Church of Eng-

land, George Whitefield, who was then traversing the colonies like another apostle to the Gentiles. The Rev. Mr. Chandler, Missionary to the little flock of St. John, wrote home to the London Society in disgust, that schism was becoming a mere "ecclesiastical scare-crow," churchmen and dissenters being so mixed up together that they would not discriminate between "Episcopal and y^e leathern mitten ordination," which his neighbor, the Rev. Jonathan Dickinson, had been defending in sundry learned essays.† The preceding rector, good old Mr. Vaughn, had died on the same day with Dickinson, exclaiming, when told that his friend was also dying, "Oh, that I had hold of the skirts of brother Jonathan!" So little after all had they been divided at heart. The type of breeding which prevailed may be suggested to us by the quaint picture of Mr. Woodruff's own son, a graduate of the College, the Rev. Benjamin Woodruff, of Westfield, who is described as "dignified and precise in his manners, social in his habits, scrupulously exact in his dress, with small clothes, silk hose, silver buckles, cock-hat and ruffles; everywhere the same and always commanding profound respect."‡ But the portrait would not be complete without the moral lineaments afforded by his epitaph as it may be read in the aisle beneath his pulpit:

The Dust lies Here
OF A VENERABLE MAN
Formed from early youth
In Learning human and divine;
Passed his Collegiate studies with reputation;
Soon entered the Holy Ministry;
Was settled nearly forty years
Pastor of this Church.
An excellent preacher,
Zealous, pathetic, prudent and successful.
In controversy moderate and calm.
Among ministers, husbands, fathers, brothers,
friends,
Few his equals.
Piety, hospitality, friendship,
Humility, benevolence and modesty,
Formed his character.

† Sprague's Annals, V, 138.

‡ Dr. Samuel D. Alexander's Princeton College in the 18th Century.

* Life and Times of Whitefield, II, 255.

Amid such influences the College had been projected when Mr. Samuel Woodruff took part in its organization. He had seen its first class of six students trained by his pastor, had entered two of his sons in its next class, and had been called to a seat in its board of trustees at the first meeting under the charter. He brought to it abilities already tested in positions of trust and influence. His wisdom, forethought and energy seem to have been at once enlisted in its service. As to the important question of its future location, he represented the chief town of the province, and probably the negotiations, as appointed by the trustees, were held in his own house at Elizabethtown with the young pastor and trustee, Elihu Spencer, among his guests. In committee with President Burr of Newark, Caleb Smith of Orange, and Sergeant, who had lately "viewed the promised land at Princetown," he discussed the advantages of that place, which was then an unpretending little hamlet, but central to the Jerseys, on the post-road midway between the growing towns of Philadelphia and New York. From two public spirited gentlemen of that neighborhood, Judge John Stockton, father of the Signer, and Judge Thomas Leonard, one of the Trustees, he took the required bond for one thousand pounds, which made Princeton the seat of the future college; and from Nathaniel Fitz Randolph, ancestor of Gov. Randolph, he received the deed of the ground which was to form its campus. A few months later, in conference with the architect, Robert Smith, father of President Stanhope Smith, he studied the plans of a college building which would be the largest edifice on the Continent. These preliminaries having been arranged, at length, on the 29th of July, 1754, he stood with the little group of trustees, patrons, villagers and workmen, gathered to lay the corner-stone of Nassau Hall. From that time forward, as

already indicated, his services were rendered during a period of nearly twenty years, embracing the administrations of Presidents Burr, Edwards, Davies and Finley, and characterized by great disappointments and struggles as well as successes. Many an informal consultation he must have had with his co-trustees and neighbors above named, who were then the ruling minds in the Board, and especially with Gov. Belcher, who was fond of styling the infant college his "adopted daughter" which he hoped to endow as a true *alma mater* of learning and piety. As executor of the Governor's will he at length had the duty of transmitting a bequest of valuable books which were the foundation of its library. At the time of his own decease, the College was attracting students from all the colonies and already had a European reputation through the writings of Edwards and the eloquence of Davies. He lived just long enough to hear that Witherspoon was coming to open before it a new era of growth and renown.

During all this portion of his life his public spirit had also been shown in the civil affairs of the province. Named in the charter for the borough of Elizabethtown in 1739, he was one of its first aldermen and its mayor from 1751 until 1759, and perhaps for a longer period. He seems to have held various judicial positions. When the seat of the colonial government was removed from Burlington to Elizabethtown, Mayor Woodruff corresponded with Governor Belcher, made arrangements for his official residence and public reception after the formal manner of the times, and began those close personal relations with him which were maintained until the end of his life. To this friendship he may have largely owed his elevation to a seat in the Royal Council. His claims for that position were thus set forth by the governor in

an official letter* to the English Ministry:

Elizabethtown, Nov. 19, 1756.

My Lords:

I am now to inform your Lordships that a few months ago died John Rodman, Esq, late of His Majesty's Council of this Province, and I would now in obedience to His Majesty's 6th Royal Instruction, nominate to your Lordships Samuel Woodruff, Esq, for filling up this vacancy, and I do with all freedom recommend him to your Lordships, as a Gentleman of strict Virtue, of good Ability, and of a good Estate; He is and has been for several years Mayor of this Town and one of the Judges of the County Court; of great Loyalty and Zeal for advancing His Majesty's Interest and Honour at all times; nor do I know a more worthy Person to supply the said Place.

Mr. Woodruff writes Mr. Partridge [in London] to wait on Your Lordships on this Occasion, and I have the honour to be with great Respect and Defence, My Lords,

Your Lordships most obedient
and most humble servant,

J. Belcher.

The King's mandamus to admit him to the Council was received July 25, 1757; he was re-appointed in 1761; and continued in office until his death in 1768. The colonies were then entering into the ferment which led to the rupture with the mother country. What his political course would have been had he lived longer, can only be conjectured. It might not be just to him to speculate as to the opinions of one who was so loyal to his king and who died before such loyalty ceased to be a virtue. By declining to attend a special meeting of the Council called to approve the odious measure known as the Stamp Act, he may have shown the spirit which afterwards became revolutionary. But a pronounced policy of this sort could only be pursued by his successor in office. On the occasion of his decease Governor Franklin addressed the following letter† to the Earl of Hillsborough, Secretary of State for the Colonies:

Burlington, Aug. 13, 1768.

My Lord:

I am just informed that Mr. Woodruff, one of His Majesty's Council for New Jersey, died on Wednesday the 10th inst: I therefore take the liberty to recommend Richard Stockton, Esq, of Princeton, to succeed Mr. Woodruff in the Council. He is a Gentleman of Fortune, Character and Ability, every way qualified to serve His Majesty in that Capacity; and, if I am not misinformed, had the honour to be known to your Lordship when he was lately in England.

I am, with the greatest respect,

Your Lordship's most obedient

and most humble servant,

Wm. Franklin.

The Richard Stockton here named afterwards became distinguished as a signer of the Declaration of Independence. During the visit alluded to he had acted for the College as clerk of the trustees in securing the acceptance of the presidency by Dr. Witherspoon and had presented to the King on behalf of the Provincial Council an address of thanks for the repeal of the Stamp Act. His appointment now follows as a matter of course. "At the Court of St. James, November 2, 1768," so runs the next official record, "His Majesty is pleased to order that the said Richard Stockton, Esq., be constituted and appointed a member of His Majesty's said Council in the room of the said Samuel Woodruff, Esq., deceased."‡

Mr. Woodruff left a large estate, comprising several plantations and town houses occupied by his children. His own residence, "Boxwood Hall," was purchased of his heirs by Dr. Elias Boudinot;|| and has since been known as the Boudinot house,

† It is a coincidence, which may interest some persons, that, after the lapse of one hundred and twenty-three years, branches of these two families, as connected by marriage, have come into possession of the Morven mansion, at a juncture when otherwise that family seat would have passed out of a succession in which it has been maintained for two centuries.

|| Hatfield's Elizabethtown, p. 588. Deeds and Mortgages, Essex Co., Book A, 1763, 1769, 1773, 1774. The place is described (1769) as land "where Joseph Woodruff now lives, and on which Hon. Samuel Woodruff, deceased, lately lived."

* Archives of N. J., Vol. IX.

† Archives of N. J., Vol. X.

where General Washington with a distinguished company was entertained on his way to New York to be inaugurated first President of the United States. The historic banquet was repeated in its dining-room at the recent Centennial, by Governor and Mrs. Green, with President and Mrs. Harrison as the guests. Of this old colonial relic the accomplished historian, Mrs. Martha J. Lamb, writes as follows: "It was a great, square, comfortable structure, with an old-fashioned gable-

roof, tall chimneys suggestive of fatherly fire-places, and a massive door with a brass knocker in the centre of a somewhat imposing front. It stood among lawns and gardens and lofty trees, very much embowered and hidden in summertime, with aspiring vines, attractive shrubbery and gay-colored flowers. There was no Jersey Street then, but the house was reached by a private carriage-way from the old road to Elizabethport. Its entrance hall and stair-case are of the style so much in fashion before the Revolution, the former being broad enough for a cotillion party. Two stately apartments on either side of this central hall reveal even at this late day many traces of former elegance and taste. The mantels with their quaint carving and the curious cornices are worthy of note. Two stories have been added to the building, which has been converted into a Home for Aged Women, but the charm of its historic associations remains."

There is much circumstantial evidence to connect this ancient mansion with the early fortunes of the College as well as with patriotic memories of later date. The prominence assigned to Mr. Woodruff as second only to the President in the Committee of Negotiation; the legal and business nature of the transaction; his varied qualifications for it as a successful merchant, mayor, judge, and king's councillor; the appointment of the meeting at his place of residence, distant from a majority of the committee; the natural choice of his house so well known as a seat of generous hospitality, and the improbability of any other choice,—all conspire to suggest that in Boxwood Hall were signed the documents which secured the foundation of Nassau Hall at Princeton.

CHARLES W. SHIELDS.



MANTEL PIECE AND WAINSCOT IN DRAWING-
ROOM AT BOXWOOD HALL.

SUMMARIES OF PAPERS PUBLISHED.

A METHOD FOR SEPARATING SULPH-
ARSENIC ACID FROM SULPH-
OXYARSENIC ACID.*

By L. W. McCAY.

In studying the reactions which take place when the pentasulphide of arsenic is acted on by the alkali hydrates† I have been compelled to work out a method for separating sulpharsenic acid from sulphyarsenic acid. The method is based upon the following facts:

1. When the solution of a sulpharsenate of an alkali is made moderately acid with sulphuric or hydrochloric acid the salt is decomposed instantaneously, and sulpharsenic acid precipitated:



The sulpharsenic acid, however, being very unstable, splits up gradually into sulpharsenic anhydride and sulphuretted hydrogen:



This tendency of the sulpharsenic acid to decompose can be in a great measure checked by keeping the solution in which it is suspended surrounded by a freezing mixture.

2. When a very dilute solution of a sulphyarsenate of an alkali is cooled in a freezing mixture and made distinctly acid with hydrochloric or sulphuric acid, the salt is decomposed and the sulphy acid liberated. In these circumstances, however, it does not split up into arsenious acid and free sulphur‡ but remains perfectly intact. The ice-cold solution will

remain clear for hours, and even small quantities of sulphuretted hydrogen fail to bring about any appreciable change. To separate then the two acids it is only necessary to see that the solution of them is very dilute (500 cm.³ H₂O:0.1250 g. As₂O₃.S₂) and at a temperature corresponding to that of melting ice. The filtering should be done as rapidly as possible, on account of the gradual decomposition of the sulpharsenic acid into the pentasulphide and sulphuretted hydrogen, and for this purpose the use of the Bunsen pump is strongly recommended. The salts used were: Bouquet and Cloez's potassium sulphyarsenate (H₂ K As O₃.S), of an exceptional degree of purity, and a sodium sulpharsenate which gave on analysis 38.01 instead of 38.08. per cent. As₂ S₅. In obtaining the results given below I proceeded exactly as follows:

The sulphy salt and sulpho salt were dissolved in 500 cm.³ ice-cold water, and the solution was then made moderately acid with dilute sulphuric acid. The flask containing the solution was placed in a freezing mixture of ice, salt and water, and a rapid current of filtered air was sucked through the liquid for about fifteen to twenty minutes. After the current of air had been stopped, and the mixture of sulpharsenic acid and pentasulphide of arsenic had settled, the clear, supernatant liquid was poured off and filtered through a Gooch crucible, and the precipitate brought into the crucible and washed thoroughly, first with water and then with alcohol. The precipitate was dried to constant weight at 110° C., and then extracted (II. and III.) five or six times with bisulphide of carbon and washed with absolute alcohol. This was done in order to remove 1—2 milligrammes of

* Orthomonosulphtrioxyarsenic Acid.

† Preliminary Notice—*Chemiker-Zeitung*, 1891, XV, 476.‡ *Zeitschrift f. analyt. Chemie*, XXVII, pp. 632-634.

sulphur which almost always remain with the sulpharsenic anhydride (I.), owing to a decomposition of some sulphuretted hydrogen which fails to escape in the drying, but splits up under the influence of the air into water and free sulphur. The cold, clear filtrate which invariably smelt faintly of sulphuretted hydrogen was saturated with chlorine gas, evaporated to small bulk and brought into a little bottle holding 200 cm³. The bottle was filled almost full of freshly boiled water, the solution saturated with sulphuretted hydrogen gas, the bottle tightly stoppered and the whole put in a boiling water bath for an hour.*

The pentasulphide was washed first with water and, in order to replace this and extract traces of sulphur, with absolute alcohol, and weighed in a Gooch crucible. Temperature of drying 110° C.

I.

TAKEN.

0.1300 g. $2(\text{Na}_3 \text{As S}_4) \cdot 15 \text{H}_2\text{O} = 0.0495 \text{ g. As}_2\text{S}_5$.
 0.1800 g. $\text{H}_2 \text{K As O}_3 \cdot \text{S} = 0.1423 \text{ g. As}_2\text{S}_5 =$
 0.1202 g. $\text{As}_2\text{O}_3 \cdot \text{S}_2$.

FOUND.

0.0516 g. As_2S_5 †
 0.1405 g. $\text{As}_2\text{S}_5 = 0.1188 \text{ g. As}_2\text{O}_3 \cdot \text{S}_2$.
 0.0516 — 0.0495 = 0.0021 g. As_2S_5 too much.
 0.1201 — 0.1188 = 0.0013 g. $\text{As}_2\text{O}_3 \cdot \text{S}_2$ too little.

II.

TAKEN.

0.1284 g. $2(\text{Na}_3 \text{As S}_4) \cdot 15 \text{H}_2\text{O} = 0.0488 \text{ g. As}_2\text{S}_5$.
 0.1896 g. $\text{H}_2 \text{K As O}_3 \cdot \text{S} = 0.1499 \text{ g. As}_2\text{S}_5 =$
 0.1266 g. $\text{As}_2\text{O}_3 \cdot \text{S}_2$.

FOUND.

0.0485 g. As_2S_5 .
 0.1490 g. $\text{As}_2\text{S}_5 = 0.1260 \text{ g. As}_2\text{O}_3 \cdot \text{S}_2$.
 0.0488 — 0.0485 = 0.0003 g. As_2S_5 too little.
 0.1266 — 0.1260 = 0.0006 g. $\text{As}_2\text{O}_3 \cdot \text{S}_2$ too little.

* Not washed with bisulphide of carbon after first drying.

† *American Chemical Journal*, IX, No. 3.

III.

TAKEN.

0.1303 g. $2(\text{Na}_3 \text{As S}_4) \cdot 15 \text{H}_2\text{O} = 0.0496 \text{ g. As}_2\text{S}_5$.
 0.1854 g. $\text{H}_2 \text{K As O}_3 \cdot \text{S} = 0.1466 \text{ g. As}_2\text{S}_5 =$
 0.1238 g. $\text{As}_2\text{O}_3 \cdot \text{S}_2$.

FOUND.

0.0496 g. As_2S_5 .
 0.1447 g. $\text{As}_2\text{S}_5 = 0.1223 \text{ g. As}_2\text{O}_3 \cdot \text{S}_2$.
 0.0496 — 0.0496 = no difference.
 0.1238 — 0.1223 = 0.0015 g. $\text{As}_2\text{O}_3 \cdot \text{S}_2$ too little.

Since sulphoxyarsenic acid is an extremely unstable compound the above method will, I think, be regarded as quite satisfactory.—Written for *Fresenius's Zeitschrift*.

ON SOME OF THE FACTORS IN THE EVOLUTION OF THE MAMMALIA.

By W. B. SCOTT.

The question of evolutionary philosophy as to which there is at present the most dispute, is undoubtedly that with regard to the causes of variation, together with the problems of heredity which are inseparably connected with it. The brilliant essays of Weismann have done great service in calling renewed attention to these fundamental questions, for there can be no doubt that most speculations upon the subject had been taking too much for granted and that the foundations of one essential part of current evolutionary belief were insecurely laid. The whole subject needs therefore to be exhaustively re-examined and tested from every side.

For the purposes of this paper it is not necessary for me to enter into the reasons of my dissent from Weismann's theory of the continuity of the germ-plasm, nor to explain why, in my opinion, so far from rendering the phenomena of heredity more intelligible, it tends to confuse them still further and to end logically in a system very like the old preformationism. As Lloyd Morgan has very pithily put it,

"I cannot but regard Weismann's doctrine of the continuity of germ-plasm as a distinctly retrograde step. His germ-plasm is an unknowable, invisible, hypothetical entity. Material though it be, it is of no more practical value than a mysterious and mythical germinal principle. By a little skillful manipulation it may be made to account for anything and everything. The fundamental assumption that whereas germ-plasm can give rise to body-plasm to any extent, body-plasm can under no circumstances give rise to germ-plasm introduces an unnecessary mystery. Biological science should set its face against such mysteries." But into this subject we need not enter, because so far as the mammals are concerned, the difficulty of comprehending how somatic changes can affect the germ in appropriate fashion so as to reproduce these changes in the offspring, is in no way diminished by a denial or even a complete refutation of the continuity theory. Weismann states the difficulty thus: "It is perfectly right to defer all explanation and to hesitate before we declare a supposed phenomenon impossible, because we are unable to refer it to any of the known forces. No one can believe that we are acquainted with all the forces of nature. But, on the other hand, we must use the greatest caution in dealing with unknown forces, and clear and indubitable facts must be brought forward to prove that the supposed phenomena have a real existence and that their acceptance is unavoidable." But does the assumption that acquired characters are transmissible involve, as a matter of fact, an appeal to unknown forces? Rather, I should say, to the as yet not well understood operation of known forces. In another connection, Weismann has himself well defended this principle, where, in arguing against the idea of a vital force, he says: "The latter [*i. e.* the ontogenetic vital force] is no longer ad-

mitted by anybody, now that we have turned from mere speculation to the investigation of Nature's processes; nevertheless its non-existence has not been demonstrated, nor are we yet in a position to prove that all the phenomena of life must be traced to purely physico-chemical processes, to say nothing of our actually being able to so trace them."

In his later papers Weismann admits that the germ-plasm may be modified in various ways. "It must be admitted that there are cases, such as the climatic varieties of certain butterflies, which raise some difficulties against this explanation. I myself, some years ago, experimentally investigated one such case, and even now I cannot explain the facts otherwise than by supposing the passive acquisition of characters, produced by the direct influence of climate." "I am at present inclined to believe that Professor Sims is correct in questioning whether sexual reproduction is the *only* factor which maintains Metazoa and Metaphyta in a state of variability." We have indeed abundant evidence that food, temperature, moisture, salt,—the like may have a profound influence upon the germ-plasm, and though we can form no conception of the way in which the amount of salt in the water will change *Artemia* into *Branchipus*, or the quantity of food will determine the proportions of the sexes in tadpoles, or how the change of food plant metamorphosed the Texan species of *Saturnia* into something very different yet we are not impelled to take refuge in an appeal to unknown forces. Nor can the well-known influence of the germ-glands upon the body be explained in the sense of determining just how and why the effect is produced. If the presence of the germ-glands can so profoundly affect the soma, why should the converse influence appear so incredible? Still more mysterious is the influence exerted upon the maternal

organism by the spermatozoa (or, perhaps, the fetus,) so that the offspring by later sires often show characters of previous sires. Virchow pronounced the stigmata of Louise Lateau to be "either fraud or miracle," but the recent investigations in hypnotism show that the case may be explained without accepting either horn of the dilemma. Whether acquired characters be transmitted or not, it is certainly inadmissible to speak of such transmission as inconceivable or as involving the operation of unknown forces.

It is extremely difficult to obtain any satisfactory evidence of the transmission of acquired characters, and this for two reasons. In the first place, it is generally well nigh impossible to determine in any given instance whether a character is acquired or congenital (employing the latter term to designate characters due to changes in the germ-plasm itself). As a rule, it is taken for granted that those structural features with which an animal is born or hatched are altogether congenital, but nothing can be more improbable, for we know that embryos are very sensitive to changed conditions and are easily modified, but to determine what characters are due to changes in the ovum and what to modifications in the embryo is a difficult matter. For my own part, I am not inclined to attach much importance to the supposed cases of transmitted mutilations, as from an *à priori* standpoint they are improbable and more especially because the long continued mutilations practiced by many savage races appear to be without result in this respect. Nevertheless such facts as those stated by Eimer and De Candolle, from their own knowledge, and the experiments of Obersteiner upon guinea-pigs, are not to be dismissed with a sneer. Arbuthnot Lane has come to the conclusion "that a force which produces no obvious change in the skeleton of the antecedents, but only a tendency to changes,

can, acting as a developmental factor, cause the apparently spontaneous development of that change in the offspring." It is also well worthy of inquiry how far the extraordinary skill and deftness of Japanese and other Oriental workmen is due to the fact that handicrafts have long been hereditary in the same families. Dall's position is an eminently reasonable one: "The contention of Weismann that 'not a single fact hitherto brought forward can be accepted as proof' of the transmission of acquired characters, demands attention. This reminds one of the familiar statement of twenty years ago that the Darwinians had not brought forward a single instance of the conversion of one species into another species. If the Dynamic Evolutionist brings forward an hypothesis which explains the facts of Nature without violence to sound reasoning that hypothesis is entitled to respect and consideration until some better one is proposed or some vitiating error detected in it." When we remember that evolution is a slow process, it is hardly to be expected that dynamic influences should be immediately apparent, though the experiments on *Artemia* and on feeding caterpillars point to a different conclusion. The question must be decided, if at all, by the inductive method, by determining how the observed facts can best be interpreted.

When we turn to the hypothesis which Weismann proposes in place of what Dall calls the dynamic theory, we might naturally require the same rigid demonstration which he demands of his opponents, but of such demonstration we find little, rather ingenious speculation. Although he has abandoned the view that sexual reproduction is the *only* factor in inducing variability, he still appears to maintain that it is by far the most important. "I am still of the opinion that the origin of sexual reproduction depends upon the advantage which it affords to the operation

of natural selection; nay, I am completely convinced that only through its introduction was the higher development of the organic world possible. . . . Even if, however, from our present knowledge it is probable that sexual reproduction is not the sole radical cause of variability in the Metazoa, still no one will dispute that it is a most effective means of heightening variations and of mingling them in favorable proportions. I believe that the important part which this method of reproduction has played in calling out the existing processes of selection, is hardly diminished, even if one grants that direct influences upon the idioplasm call forth a portion of individual variability." Weismann still maintains that somatogenic characters, the effects of use and disuse, cannot be transmitted and attempts to "elucidate the phenomena without the aid of this principle."

But, as Lloyd Morgan has pointed out, "by sexual admixture alone, there can be no increase or decrease, beyond the mean of the two parental forms. If, then, the union of the sperm and ovum be the source of new or more favorable variations, other than or stronger than those of either parent, this must be due to the fact that the hereditary tendencies not merely combine, but under favorable conditions combine, in some way different indeed from, but perhaps analogous to, that exemplified in chemical combination." Of course, such organic combination is not vouched for by a particle of evidence. Again, on the theory of heredity propounded by Weismann, such variations are necessarily single, and there is no probability that the same variation will arise twice even in the same litter. Now it has never been shown that such variations can be perpetuated in spite of the swamping effects of free intercrossing, nor that such minimal differences as a slight shifting of the carpal and tarsal clements

or the presence of a tiny incipient cusp upon a tooth, can be of decisive effect in the struggle for existence. This difficulty has long been felt and many attempts have been made to meet or to evade it. Weismann has stated the case thus: "Such calculations as those quoted by Darwin from the article in the *North British Review* for March 1867 are extremely deceptive, since we have no means of measuring the amount of protection afforded and we can therefore hardly compute with any certainty in how great a percentage of individuals a change must contemporaneously occur in order to have a chance of becoming transferred to the following generation. . . . *Variations which occur singly have but little chance of becoming predominant characters* and this is obviously what Darwin concedes, but this is by no means equivalent to the assumption that only those variations which from the first occur in numerous individuals, have a chance of being perpetuated." But it is difficult to see on Weismann's principles how variations can occur other than singly (*i. e.* excluding those cases of the influence of the environment upon the germ-plasm, by which many individuals are simultaneously affected) except in the direct line in which the changes first appeared, for by hypothesis every fertilized ovum is different in important respects from every other and on the doctrine of chances there is only an infinitesimal probability that it can ever be duplicated. The argument that variations do occur in nature sufficient to give the necessary material for the operation of natural selection, does not touch the real difficulty, which is, what *causes* these variations? It is taking a great deal for granted to assume that they are solely or even mainly to sexual reproduction.

The relatively fixed direction taken by variations, which has been insisted upon by so many observers (*e. g.* Askenasy,

Eimer, Geddes, Thompson and Osborn,) comes out most clearly in the series of fossil mammals. Granting that unlimited variation is no necessary part of the selection theory, it seems strange that new facets on the bones and new cusps on the teeth should appear only in such definite ways and that there should not be many tentative attempts and false starts before the proper development is hit upon. In the structure of the carpus and tarsus we find that in any given phylum very definite lines of evolution are early established and closely adhered to, and the changes are just those called for by the operation of dynamical influences. If Weismann's position were correct, we ought to find much greater latitude of variation.

It is thus difficult to understand how even a single variation can be established by the unaided operation of sexual reproduction and natural selection, but the difficulty is greatly increased when we take into account the phenomena of parallelism and convergence. The selenodont type of molar tooth has been independently acquired in at least three lines and probably in many more. The molariform premolars which occur in so many perissodactyls, in some artiodactyls and in other groups, though copying more or less exactly the pattern of the molars, are composed of parts which are not homologous with those occupying similar positions in the molar crowns. These changes can be followed step by step and accounted for, if we admit the action of mechanical influences, but are very puzzling on the hypothesis of all round variation. The spout-shaped odontoid process of the axis occurs in the camels, the true ruminants, the horses and other groups and it has been shown that this structure is not due to inheritance from a common ancestor, but has been separately acquired. Still more striking is the case cited by Kowalevsky of

the sudden and simultaneous appearance (using these terms in their geological sense) in so many different groups of the prismatic or rootless molar, with very complex enamel foldings and the valleys filled with cement. Kowalevsky believes that the occasion of this remarkable revolution, as it may fairly be called, was the great extension of the grassy plains and the consequent change on the part of most herbivorous animals from a diet of soft plants and leaves to the siliceous grasses. Now what is the probability that such a series of changes in horses, rhinoceroses, pigs, ruminants, elephants and other families, should be due primarily to the mingling of different hereditary tendencies, especially when it is remembered that none of the ancestors of these groups possessed any such teeth? Or can it be reasonably contended that such parallel variations are due to the direct action of the climatic or other environment upon the germ-plasm? The tendency to the formation of prismatic molars appears even in the early Tertiary times, as is seen in *Paloplotherium* and *Hypisodus*, but these were premature attempts and led to nothing. Cope has shown how clearly the skeletal peculiarities of the feet of the Tylopoda may be deduced from the mechanical effects of the cushion or pad upon which the foot rests, and I may add that the steps of the enlargement of this pad may be inferred, in the extinct forms, from the successive changes in the phalanges. The similarities between the elephants on the one hand and *Uintatherium*, on the other, are just those which must accompany greatly increased height and bulk, though the latter is the more important factor.

Furthermore, the facts of pathology and surgery bring clearly before us the way in which the skeleton is moulded by the pressures and strains to which it is subjected. The tendinal sulci are formed by the pressure of the tendons, and if these

tendons are dislocated, the old grooves are gradually filled up and new ones formed. "After dislocations the old articular cavities will be filled up and disappear, while at the new point where the bone is actually placed, a fresh articulation is found, to which nothing will be wanting in the course of a few months, neither articular cartilages, synovial fluid, nor the ligaments which retain the bone in place." (Marey). The arrangement of the trabeculae in the interior of the bones is in the direction of the line of the greatest pressure and strain, giving great strength with a minimum of material. When, by a fracture and re-union the relation of the bone to the line of strain is changed, the direction of the trabeculae will be correspondingly altered. The papers of Arbuthnot Lane give an admirable account of the way in which long-continued routine labor will modify the shapes and articulations of the bones. It would, however, be a mistake to suppose that the bone-structure is entirely due to influences exerted in the life-time of the individual, for the facts of development show that these structures appear in the fetus before such influences are exercised.

The proximal end of the humerus is very similar in the White River representatives of the horses and camels (*Mesohippus* and *Poebrotherium*) having the bicipital groove single, narrow, and placed at the antero-internal angle of the head, while the external tuberosity is very large and extends across nearly the entire anterior face of the bone. In the modern forms the bicipital groove is double, being divided by the large bicipital tubercle, and the external tuberosity is reduced to the size of the internal one. If all these changes, which are carried out in such exact accord with the mechanical exigencies of each case, are not somatogenic how can they be accounted for? What chance is there of such oc-

currences repeatedly taking place in widely separated groups of animals as the result of sexual reproduction, or of changes in the germ-plasm which stand in no other causal connection with the mechanical needs of the body, than that these variations which happen to be favorable are preserved? The improbability of such an explanation is still further increased by the fact that the numerous non-mechanical variations, which on this theory ought to occur, are not to be found in the fossil series except very rarely, and then as the manifest results of disease or accident. Why should there be such a profound difference between the method in which useful changes are brought about in the individual and those which modify the species? and how can we explain the mysterious pre-established harmony between the two classes of phenomena? It seems very wonderful that an "ever vigilant natural selection," which introduced sexuality for the very purpose of producing and combining variations, should have failed to seize and make use of somatogenic changes.

This class of phenomena is by no means confined to the vertebrate skeleton. Dall has shown how the characters of the hinge and shell of the bivalve mollusks have been evolved in accordance with mechanical principles. He has also shown "how the initiation and development of the columellar plaits in *Voluta*, *Mitra* and other Gasteropods, is the necessary mechanical result of certain comparatively simple physical conditions; and that the variations and peculiarities connected with those plaits perfectly harmonize with the results which follow with inorganic material subjected to analogous stresses." Neumayr, in describing the transition of *Paludina Neumayri* into *P. Hoernesii* says: "Wenn man ein Thonmodell von *Pal. Neumayri* hätte und dasselbe auf die einfachste und kürzeste Weise in *Pal. Hoernesii*

umformen wollte, man könnte es kaum anders machen als die Natur vorgegangen ist." Jackson has reached very similar results in the same department of investigation.

[Abstract of a paper read before the Princeton Biological Club.]

THE STRUCTURE OF INSECT-TRACHEÆ.

By GEORGE MACLOSKIE.

In 1884 I published a short paper to show that the tracheæ of Insects have been usually misunderstood, giving reasons to believe that the spiral thickenings are really spiral convolutions, like the wrinkles in the sleeve of a coat, that they are channel-like folds open outwards by a slit or fissure.

This view was reached as an inference from my own examination of the pseudo-tracheæ of the Horse-fly, and from Kraepelin's examination of the teeth of the Blow-fly; and I found confirmation of it in certain markings on the tracheæ. Such evidence, however, being of an indirect character, has not satisfied others; and Miall and Denny in their Monograph on the Cockroach after criticizing my work reproduce Chun's figure which erroneously represents the Insect-tracheæ as having a long free spiral thread like vegetable tracheæ.

This criticism has compelled me to re-examine the subject, with the curious result that not only does my view prove to be the correct one, but that after all the work and the multitudes of papers issued on this theme, it can be easily observed with the microscope. The hypodermis surrounding the tracheæ sometimes obscures their profile at the edge; but it is usually possible to observe in a medium-sized branch, especially when slightly stretched under the cover-glass, that the spirals are

folds of the chitine-wall, grooved on the outside, the channels showing in profile along the edge, like the thread of a screw. Not only have I seen this in many fresh specimens, but in an old mounted specimen of the internal parts of a Fly it is plainly visible. It is singular that so obvious a character has hitherto escaped notice. Prof. H. T. Fernald informs me that by means of sections he has confirmed this view.

Dec. 29, 1891.

[Abstract of paper read before the American Society of Naturalists.]

GRAPHICAL SCIENCE—PAST AND PRESENT.

By FREDERICK N. WILLSON.

In view of the accepted division of mathematical properties into *metrical* and *descriptive* and of the more general sense in which the title *Descriptive Geometry* (*darstellende Geometrie*, *Géométrie Descriptive*) is now used abroad, the following was presented as a definition therefor: "Descriptive Geometry is the science in which figures are represented and their descriptive properties investigated and demonstrated by means of projection."

Its sub-divisions were then indicated as follows:—

- (a) *Projective Geometry* (*Geometry of Position*).
- (b) *Perspective*.
- (c) *Relief-Perspective*.
- (d) *Shadows* (*artificial light*).
- (e) *Photometry*.

UNDER PARALLEL PROJECTION.

Oblique or *Clinographic Projection*, otherwise *Cavalier Perspective* (plane vertical) or *Military Perspective* (plane horizontal). *Shadows*.

PERPENDICULAR OR ORTHOGRAPHIC
PROJECTION.

Special names when but one plane of projection is employed:—

(a) *One-Plane Descriptive*, otherwise *Horizontal Projection*;

(b) *Axonometric* (including *Isometric*) *Projection*.

When on two (or more) mutually perpendicular planes the title *Monge's Descriptive* is suggested, that as in the case of Cartesian geometry the name of the inventor may be perpetually associated with his creation and also in view of the more extended significance of the title "Descriptive Geometry."

After considering the characteristics and applications of the foregoing sciences their early history was traced; particular mention and demonstration made of the principles and development of Relief-Perspective; and the present place of the various divisions of Graphics in the curricula of Foreign and American technical schools compared.

[Abstract of paper presented before the Princeton Science Club, December 10th, 1891.]

JAMES RUSSELL LOWELL, AS A PROSE
WRITER.

By T. W. HUNT.

After briefly sketching Mr. Lowell's life and personal character and enumerating his various writings, the special topic was taken up and the leading qualities of Mr. Lowell's Prose were discussed.

These were said to be, Clearness, Directness, Ease and Taste and Classical Finish, and, as most important, Mental Vitality. Particular attention was called to Mr. Lowell's English; to his love of Old English books and authors; to his brilliant work as a literary critic; to the cheerfulness and wholesomeness of his Prose, and to the preëminently literary type of his personality and writings. Current objections to his critical methods and spirit were answered, while the paper, at its close, emphasized the fact of the great loss which English Letters had sustained in Mr. Lowell's death.

[Read at Washington, Dec. 29, 1891, before The Modern Language Association of America.]

NOTES.

THE AMERICAN SOCIETY OF
NATURALISTS.

At the meeting of this Society held in Philadelphia on Dec. 30, 1891, several professors from Princeton were present and took part in the proceedings. The proceedings of the meetings fell naturally into two parts, first, a discussion on Definite versus Fortuitous Variation, and second, reports of scientific expeditions.

The discussion of variation was opened with a paper from Professor Meehan, who considered the question from the botan-

ical standpoint. Professor McMurrich, Professor Allen and Professor Cope then followed, discussing the subject in connection with invertebrate zoology, vertebrate zoology and palæontology respectively. In the discussion which followed the reading of these papers, Professors Macloskie, Osborn and Libbey took part.

One of the expeditions reported on was that of Professor Baur to the Galapagos Islands. He described the peculiarities of those islands and of their fauna, and gave an account of his collections. A part of these collections will come to the Princeton museums.

Professor Libbey gave an account of his measurements of ocean temperatures near the Gulf Stream, and added considerably to what has before been published about this work. After giving an account of his methods of observation, he proceeded to show that there were two different sets of currents, one a deep series and the other a surface set, both being modified by the mechanical laws of their motion, by changes in velocity, temperature and density. But the surface currents were further modified by the direction, duration and velocity of the wind currents.

The appearance of smaller band-like currents upon the north-bound Gulf Stream, which were reversed in the direction of their motion after they had passed somewhat to the northward, was explained and offered as a reason for the appearance of schools of fish at different points of the coast, since the warmer waters provide the proper conditions for the growth and distribution of the fishes' food by the bridging over of the cold current.

The effect of the winds on the modification of the northern boundary of the Gulf Stream was pointed out, and it was shown that it was moving towards the shore off the New England coast. The pilot charts of the North Atlantic coast, in which were given the direction and velocities for the last three years, were quoted in support of this view. Further the influence of these changes in the conditions of temperature and moisture upon our climate were pointed out and some explanations offered.

At the meeting of the Morphological Society held immediately before the meeting of the Society of Naturalists, papers were read by Professor Macloskie, Professor Osborn and Dr. McClure.

THE PRINCETON ALUMNI UNIVERSITY FUND.

It is a matter of great gratification that the Alumni of Princeton are now being

organized in an effort to raise by subscription a substantial University Fund. The needs of a growing institution are always in excess of its existing revenues and the fact that the rich endowments of the Old World are not yet distantly approached by any American University lends additional urgency to the appeal now issued by a committee of the Alumni recently appointed by President Patton.

If Princeton is to advance to the position of leadership which her authorities and alumni so earnestly desire, there should be large additions to her endowment,—larger proportionally than even the munificent sums received in the last two decades. Every additional building (except dormitories) makes additional charge on the institution unless the building be supplemented with endowment for its care, insurance and repair. Every additional student, even when paying all his college bills, needs endowment. It has been shown that for every thousand dollars of revenue in the budget of our larger institutions only about three to five hundred at most come from the students, and consequently any great increase of students calls for a corresponding increase in endowments of necessity, if the equipments of education are to be maintained in effective influence on the education of the students themselves. There is a natural limit to what can be done with an existing "plant" and that limit has now been passed here. Our student increase in the last six years is over ninety-six per cent., but our endowments have not kept pace with this phenomenal student growth.

Princeton urgently needs half a million of dollars for her general fund at once, to meet immediately pressing wants.

Then if we look to a great growth toward a strong university life, there should be round millions of dollars for additional professorships, university fellowships of research, for the extension of the library, for

the general strengthening of the college course, and for all that goes to equip and secure a University in the future.

The revenues of Oxford and Cambridge represent a capital of about seventy-five millions of dollars. The University of Leipsic is worth nearer twenty than fifteen millions. Let us measure our effort by such endowments, however far American institutions fall short of them at present.

The effort of the alumni is well conceived and in good hands. If there can be added from year to year such a sum as they propose, the improvement of Princeton will be greatly accelerated, and the way will be cleared for a still greater future advance. It is to be hoped that a general response in the way of subscriptions will be the prompt result of this appeal, and that Princeton and her alumni will be more closely identified than ever before.

The committee is as follows :

Charles E. Green, '60.

James W. Alexander, '60.

Adrian H. Joline, '70, *President*, 54 Wall Street, New York City.

William B. Hornblower, '71.

Charles Claflin Allen, '75

John C. Ten Eyck, '75, *Secretary*, Box 175, 120 Broadway, New York City.

J. Bayard Henry, '76.

Robert W. Johnson, '76.

M. Taylor Pyne, '77.

George A. Armour, '77.

William W. Lawrence, '78.

C. C. Cuyler, '79, *Treasurer*, 52 William Street, New York City.

Arthur H. Scribner, '81.

Charles W. McAlpin, '88.

All subscriptions should be sent to Mr. C. C. Cuyler, 52 William St., New York.

of Falckenberg's *Geschichte der neuern Philosophie*, to be published by Messrs. Holt & Co. of New York. Prof. Falckenberg was formerly Privat-Dozent at Jena, and is now Professor Extraordinarius at Erlangen. He has previously published on the Kantian doctrine of the Will, and on the system of Nicholas of Cusa. The merits of his Compend of Modern Opinion for American Students are, (1) its comprehensive character; (2) the author's skill in objective exposition, without intrusion of his personal views; (3) his appreciation of English philosophy and thorough acquaintance with it; (4) his discussion of 19th century philosophy down to the present time. It is believed that the English translation will meet the need now widely felt for a treatise intermediate between the exhaustive works of Ueberweg and Erdmann, and such sketches as that of Bowen. The translation will be made with Professor Falckenberg's cordial consent and coöperation.

Since the last issue of the BULLETIN the following appointments have been made: Henry Dallas Thompson, D.Sc., Princeton, Assistant Professor of Mathematics. Marion Mills Miller, Litt.D., Princeton, Assistant Professor of Oratory and Æsthetic Criticism. George McLean Harper, A.B., Assistant Professor of French. Rev. John Grier Hibben, A.M., Instructor in Logic. Charles Sidney Smith, A.M., Instructor in Latin. Charles F. Williams McClure, A.B., Instructor in Biology. Nicholas Everton Crosby, A.M., Instructor in Greek and Latin. F. Neher, A.M., Assistant in Chemistry. Barton Cruikshank, Instructor in Graphics.

Professor Armstrong of Wesleyan University, a graduate of the Class of 1881 in Princeton, has in preparation a translation

Early in April, Funk & Wagnalls of New York will publish "Ethical Teachings in Old English Authors," by Prof. Hunt.



CHARLES AUGUSTUS AIKEN, PH.D., D.D.

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. IV.

APRIL, 1892.

No. 2.

PROF. CHARLES AUGUSTUS AIKEN,
PH.D., LL.D.

Charles Augustus Aiken was born Oct. 30, 1827, in Manchester, Vt. His father, John Aiken, was of that Scotch-Irish stock which first settled in Londonderry, N. H., and was a fine type of its well-known sterling qualities of mind and character. He was a man of leading position and influence, from his early professional life as a lawyer in Manchester, throughout his long business career as agent and treasurer of large manufacturing corporations in Lowell, Mass., and Dover, N. H. He was more widely known and valued for his services to higher education and religion, as a Trustee of Dartmouth College, his Alma Mater, and for many years President of the Board of Trustees of Andover Theological Seminary, and also for many years a member of the Prudential Committee of the A. B. C. F. M. with most assiduous devotion to its interests. Dr. Aiken's own mother was a daughter of Professor Adams of Dartmouth College. She died when this son was but two years old; but, three years later, his father married a daughter of President Appleton of Bowdoin College, a lady of rare loveliness of person and character. By her tender and gracious maternal love the step-son was nurtured as faithfully as were her own children subsequently born; and to that love and care he always made the return

of an affectionate, and grateful, and reverent son.

The boy was precocious. At the age of three he is said to have read from the Bible at his grandfather's knee. At the age of twelve he was ready for Dartmouth College, whose requirements for admission were substantially equivalent to those of Princeton and of the other leading colleges to-day; but he was wisely kept at home in Lowell for nearly three years, till he should be more mature in body and mind. Meanwhile he continued reading and study, but chiefly received a valuable practical training in business life by the employment which his father assigned him in the mill of which he was agent.

In 1842 he entered Dartmouth College when still only fourteen, a boy of a rarely attractive face and person, spirited and juvenile enough, throughout his course fond of sport and athletic games, cheery and companionable, with musical gifts that made him President of the Handel Society and leader of the college choir; but withal excelling always as a scholar, and graduating in 1846 easily at the head of his class when not quite nineteen years old.

The young man at once devoted himself to teaching; first, for a year, in the Lawrence Academy at Groton, Mass., and then for two years, in Phillips Academy, Andover, Mass. Here, especially, he began to develop that skill as an Instructor, that power to stimulate his pupils, and that

good judgment and tact in the management of his classes which eminently marked his later career in the sphere of higher education.

For some years following, however, his life as an instructor was interrupted by an experience that only served in the end to enrich it with spiritual power, and to widen and elevate the sphere of it. He became an earnest christian man at Andover in 1848, united with the church, and very soon resolved to devote himself to the christian ministry. His course of theological study was begun in Andover Theological Seminary in 1849, and, after a year there, was continued for two years abroad, in Halle, Leipsic, and Berlin. A few weeks sufficed him, with his linguistic facility, for acquiring enough proficiency in German, which he had not studied before, to enable him to begin taking university lectures. His more special studies were in Oriental Languages and Egyptology, but combined with courses in Archaeology, Theology, Biblical Literature and Criticism, Ecclesiastical History, and History of Philosophy. His letters, during his period of foreign study, make very evident his tireless industry and energy as a student, and the acceptance he found with the eminent men in those universities whose instructions and guidance he specially sought, such as Hupfeldt, Rödiger, J. Müller, Tholuck and Lepsius. For he and other promising American students were admitted to much personal intercourse with these Professors in walks and private interviews and discussions which stimulated to the utmost their powers of thought and acquisition. On returning home in 1853 he finished the year in the Seminary at Andover and graduated there. He spent the following year also there as a graduate student, and at this time published the first-fruits of his foreign study in an article in the *Bibliotheca Sacra*, Jan., 1854, on The Comparative Value of Eng-

lish and German Biblical Science. In July, 1854, he published, also in the *Bibliotheca Sacra*, a translation from an elaborate treatise by Tholuck on Citations of the Old Testament in the New, with Notes.

In October, 1854, he was ordained and married, and entered upon his only pastorate, that of five years duration at Yarmouth, Me. For some time previous he had seriously considered the question of his duty to devote his life to Foreign Missions, especially at Beirut in Syria, but decided that it was not his duty to go. He always retained the deepest interest in missions, and helped many young men to decide for work in foreign fields. His work at Yarmouth was that of a studious and able preacher, a faithful pastor, and a man of spiritual experience and power. It was fruitful of results in the greatly increased membership and effective strength of that church, and in the valued influence he had in that community and in the neighboring region as a christian man and minister. One of his timely and effective sermons, that on Temperance, was published in 1858 at the request of a large number of his leading hearers.

But Dr. Aiken's most special gifts and training were, and were well known to be, for scholarship and teaching, and he was soon to enter upon the chief work of his life in the field of higher education. During his pastorate at Yarmouth, in 1856, when plans were maturing for establishing the Theological Seminary of Chicago (Congregational), he was unanimously elected by the Board of Directors to their chair of Biblical Literature. For certain reasons, involving much delay in the completion of the organization, he decided to continue his pastorate. In 1859, however, he accepted from his Alma Mater an invitation to the chair of Latin Language and Literature, and held it till 1866, when he accepted a call to the same chair in the College of New Jersey and remained in Princeton till

1869. During these ten years as a college professor, Dr. Aiken established so high a reputation as an educator, by his scholarship, by his thoroughness and skill in the class-room, by his just, wise, and kindly share in the administration of college discipline, by his devoted christian character, and by his intelligent views of the management of college interests in general, that, in 1869, he was invited to the Presidency of Union College at Schenectady, N. Y. The good success of his two years in that office was attested by the most cordial expressions of appreciation, both public and private; but when the invitation to the newly-established chair of Christian Ethics and Apologetics in Princeton Theological Seminary came to Dr. Aiken, his earlier taste and training for work in such a Seminary, and his fondness for Princeton as a place of residence, constrained him to accept, and he was inaugurated in November, 1871, into that Professorship. In subsequent enlargement of the Faculty and readjustment of the courses of study he gave, for a time, instruction in Hebrew and Old Testament Criticism and Introduction; but in 1886 he surrendered the instruction in Hebrew and continued his Professorship under the title of Oriental and Old Testament Literature and Christian Ethics, to which was added, in 1888, that of Stuart Professor of the Relation of Philosophy and Science to the Christian Religion.

At the same time with these Professorships, Dr. Aiken filled various positions of trust and usefulness. In 1872 he became a member of the American Committee on Revision of the Translation of the Old Testament. For several years he was Librarian of the Theological Seminary. In 1879-80 he was Associate Editor of the *Presbyterian Review*. At the founding of the John C. Green School at Lawrenceville, N. J., in 1882, he became one of its Trustees. In 1888 he was a delegate to the Mission-

ary Conference and Presbyterian Council which met in London; and, at the time of his death, was a member of the Presbyterian Council appointed to meet in Toronto, Canada, in September, 1892. His last service of this nature was to meet in New York, December 31, 1891, with the Committee on Programme for that Council.

Dr. Aiken received the honorary degree of Ph.D. from Princeton in 1866, and in 1869 that of D.D.

The published writings of Dr. Aiken, in addition to those of 1854 mentioned above, are:

The Epicurean Philosophy, *Princeton Review*, April, 1867.

Schaff's History of the Christian Church, *Princeton Review*, July, 1867.

Whitney's Language and Science of Language, *Princeton Review*, 1868.

Zoeckler's Commentary on Proverbs (translated and edited), 1869.

Memoir of Rev. John Keble, *Princeton Review*, July, 1869.

Inaugural Discourse at Union College, January, 1870.

Inaugural Discourse at Princeton, Nov., 1871.

Catholic and Protestant Treatment of Christian Evidences, *Princeton Review*, Jan., 1873.

Matthew Arnold's Literature and Dogma, *Princeton Review*, 1874.

Mohammedanism as a Missionary Religion, *Princeton Review*, 1879.

Address before the Φ B K Society of Dartmouth College, 1882.

Address before the Alumni of Dartmouth College, July, 1886.

Christianity and Social Problems, *Presbyterian and Reformed Review*, Jan., 1892.

His communications to religious newspapers, of a somewhat extended character were such as these:

The Proper Names of the Bible.

The Waning Prestige of the Ministry, *Catholic Presbyterian*, April, 1880.

The Minor Prophets in the New Revision, *Sunday School Times*.

Our Poor Ministry.

His very numerous notices of books, some of them critical and extended, appeared in every number of the *Presbyterian Review* and its successor, the *Presbyterian and Reformed Review*.

This scholarly, useful, and christian life, maintained with great energy and spirit, for some years before its close, in continual conflict with disabling disease, ended, after a short attack of acute illness, Jan. 14, 1892. The hearty and discriminating tributes paid at the funeral services held Jan. 16th, by Professor Young of the College, by Rev. Dr. Paxton of the Seminary, and by Rev. Dr. Mudge of the Second Presbyterian Church, gave expression to the due appreciation of the more intimate personal qualities and services of Dr. Aiken in his relations to the institutions, the church, and the community of Princeton.

W. A. PACKARD.

THE STONE LECTURES FOR 1892.

The L. P. Stone Lectures for 1892 were delivered in the oratory of Stuart Hall by the Rev. S. H. Kellogg, D.D., pastor of the St. James' Square Presbyterian Church of Toronto, Canada. The course consisted of eight lectures upon "Modern Theories of the Origin and Development of Religion."

Lecture I took up the question, What is Religion? and sought a definition which would be sufficiently inclusive, embracing the elementary as well as the most highly developed forms of religious faith. Various definitions that did not stand this test, such as those of Spinoza, Kant, Fichte, Réville, Feuerbach and Gruppe, were given and declared inadequate, as were those of Goethe, Teichmüller, Schleiermacher, which base religion on feeling. Those of Hegel, Caird and Max Müller, which

centre religion in the will, were also discarded. Dr. Kellogg gave his own definition as follows: Religion consists in man's apprehension of the existence of an invisible power or powers, and of his relation to this invisible power or these powers, to whom he feels himself subject, and who determine his destiny, together with what this feeling calls forth. This definition includes not only all forms of religion, but also the entire nature of a man, intellect, emotions and will.

Lecture II treated of Religion and "Natural Descent:" Fetichism and Animism. On the basis of the truth of the Darwinian theory primitive monotheism must be abandoned. The testimony of Virchow and Wallace was quoted against this theory. Lacking proof it cannot sustain fetichism and animism as the earliest forms of religion. Tiele argues for primitive animism on the ground of the low intellectual condition of the earliest men. Yet this is unproved. The testimony of language is rather against it, and it is a mistake to regard modern savages as primitive types. A belief in a personal God is found to co-exist with animism and fetichism.

Lecture III discussed Herbert Spencer's Ghost Theory. According to this, ancestor worship was the earliest form of religion. The primitive men saw that they were accompanied by shadows. They began to regard these as independent entities, separate from themselves. In dreams the spirit left the body and did what it seemed to do. Thus they were led to believe in the spirit's survival and activity after death, with increased power for good or evil. One more powerful than the others was elevated above them, and the idea of a God was evolved from the idea of a ghost. But Spencer's *a priori* primitive man is a *petitio principii*. His theory denies innate ideas; does not account for the phenomena of sin, or the whole content of the idea of God. Primitive ancestor

worship is not most common among the most degraded people: witness the Chinese.

Lecture IV was on Max Müller's theory of the origin of religion. His attitude toward Christianity and the Bible has become hostile. He maintains that religion began with the sense-perception of the infinite and classified sense-percepts as "tangible, semi-tangible and intangible." The first were small objects, such as stones; the second, larger objects, only a part of which could be touched, such as mountains; the third, objects such as the sky. In primitive Indo-Aryan religion he finds a progress from henotheism to monotheism. The origin of religion is explained by the origin of language. He defines the infinite erroneously, and assumes sensationalism. The religious development in India has not been toward monotheism, but toward pantheism.

Lecture V dealt with the true Genesis of religion in Dr. Kellogg's judgment. There are in it two factors: one subjective, the constitution of man; the other objective, revelation. The universality of religion demonstrates that man is a religious being by nature and not by development. Among all races, however degraded, there is a sense of dependence upon a superior, invisible power. The very laws of thought constrain belief in such a being. Conditioned being implies a being unconditioned and conditioning. Conscience bears testimony to such a being, as does the craving for fellowship with the unseen power. These are universal facts. It is objected against this that there are many races without religion, and that there are individual cases of atheism. The first of these objections is not in accordance with the facts, and the second has no weight. Men are rational beings, in spite of the existence of idiots. As to the objective factor, only a revelation will account for the spontaneity, the universality, the intensity and the persistence of religious beliefs.

The denial of revelation involves the denial of the possibility of knowledge. This revelation of God is found in conscience, in the mind, and in the universe of matter and force.

Lecture VI was on the development of religion, with the consideration of sin as a factor in this development. Development is not inconsistent with supernaturalism. The primitive form of religion was doubtless elementary, but not therefore erroneous. The great question is as to the order of development. Was monotheism its beginning or its termination? Réville makes polytheism original. Sin involves a degradation of man's conceptions of Deity, and a predisposition toward false beliefs, such as atheism, agnosticism and pantheism, and its presence in the world makes it inconceivable that man should have advanced from a lower to a higher form of religious faith. There is no tendency in sin to self-improvement.

Lecture VII gave the order of religious development as found in historic facts. In Egypt there is seen a coexistent polytheism and monotheism. The former was a corruption of the latter. In India are found evidences of an earlier monotheism preceding the later pantheism of the religious development of that country. The religion of the Babylonians is an apparent exception to the rule. No tendency to monotheism is found in ancient Babylonia. After sketching the religious history of China and of various savage tribes, Dr. Kellogg concluded that no Indo-Germanic or Turanian people has ever shown a monotheistic tendency. The existence of monotheism among them cannot be explained by a development from a lower to a higher form of religious life.

Lecture VIII closed the course with a discussion of Shemitic monotheism. This is an asserted exception to the religious degeneration of the human race. Monotheism is stated to be of Shemitic origin. Yet

the tendency to decline from monotheism is a marked feature of Shemitic history. This is seen in the case of the Euphrates Shemites, in the worship of trees and stones, in the Arabian tendency downward, in Mohammedan concessions. The alleged natural evolution of monotheism by the Hebrews is not according to historic facts, as witness the whole course of their history from patriarchal times down to the total lapse of the Ten Tribes. Subsequent Hebrew monotheism has been in spite of nature. The facts, as we have reviewed them, are irreconcilable with the gradual evolution of theism from a low form of primitive faith. J. H. DULLES.

THE LIBRARY.

The following is an account of some of the recent accessions and changes in the College Library:

Accessions Aug. 1, 1890,—Aug. 1, 1891, Books, 2,431.

Accessions Aug. 1, 1891, to date, (Mar. 8, 1892), 1,387.

Total at date, 84,759.

Circulation, (regular issues), Aug. 1, 1890,—Aug. 1, 1891, 17,634.

Circulation for previous year, 12,323.

Circulation, Aug. 1 to end of first term of this year, 10,234: to date, 12,866.

Increase over same period last year, 2,480.

The subject catalogue has been scattered in four alphabetical series in such a way that all four must be consulted in order to find what the library has on a given subject. These have this year been combined in an alphabetical series on cards. This combined catalogue will, it is expected, be ready for use May 1 or sooner. A complete author catalogue is also in an advanced state of preparation, which, it is hoped, will considerably facilitate use.

Both of these are on the basis of the previous catalogues, which have been

very largely supplemented, as well as re-arranged and combined. The method has been in general to use existing material so far as it went, wherever it served its practical purpose, without trying to conform it to a different standard.

The same is true in a measure of the re-classification on the shelves which has been forced by the overcrowding of the space allotted to the various classes. The method of arrangement in the new classification will be the "Relative" method which allows of indefinite increase without re-classification. This work has already been begun in four departments, where the professors in the departments have indicated a wish for it, and will be pushed as fast as the library force will permit in the order of greatest need or the expressed wish of the professors of the various departments.

The funds at the disposal of the Librarian for library help being no greater than they were two years ago, while the use of the library and the number of new books to be cared for has nearly doubled, these somewhat comprehensive efforts at increasing the efficiency of the library cannot be advanced as fast as either librarians or users might like. The work this year has been handicapped too by the fact that both the regular cataloguers have been ill for several months. The work is, however, being steadily and systematically pressed.

Among the needed improvements which have been actively considered by Faculty and Trustees, but are classed only as "hopes," are: more money for new books, the lighting of the present building by electricity, an extension of the present building, which shall at the same time provide greatly needed space for books and release the present building for equally needed reading room space.

The gift of M. Taylor Pyne, Esq., of Stevens, Fac-similes of manuscripts relat-

ing to America—a collection interesting, expensive, indispensable to a college library, and of peculiar interest to Princeton on account of her historic relations with the founding of the United States—deserves special notice in the BULLETIN.

Another box of books has just been received from Mr. Pierson, an addition to the remarkable war collection which he is forming for this library.

THE REV. CHARLES K. IMBRIE, D.D.

Charles Kisselman Imbrie, who was a Trustee of the College for thirty years, was the son of James and Margaretta (Kisselman) Imbrie, and was born, Dec. 15, 1814, in Philadelphia, Pa. His preparatory studies were pursued at the classical school of the Rev. Sam'l B. Wylie and Jos. P. Engles, of Phila., and at the Franklin Institute of the same city. He spent two years as a clerk in a hardware store in Philadelphia, before entering Princeton College in 1831, from which institution he graduated in 1835. From Oct. 1835 to Dec. 1836 he was private tutor in a family at Natchez, Miss. He entered the Seminary at Princeton in 1836, ill-health necessitated the repetition of the first year, and

he graduated in 1840. During two years of his Seminary course he served as tutor in the college. He was licensed, Oct. 7, 1840, by the Presbytery of Philadelphia, and ordained, Jan. 5, 1841, by the Presbytery of Elizabethtown, at Rahway, N. J., and at the same time installed pastor of the First Presbyterian Church of Rahway. This pastoral relation was dissolved Jan. 6, 1852. His second and only other pastorate was over the First Presbyterian Church of Jersey City from Feb. 11, 1852—April 17, 1888. At this time the church was moved to Bergen Heights and became united with the First Presbyterian Church of Bergen. Of the united church Dr. Imbrie was pastor emeritus from March, 1890, till his death, which occurred in Jersey City, Nov. 20, 1891, of pneumonia. From 1857–70 Dr. Imbrie was Recording Secretary of the Presbyterian Board of Foreign Missions, and a member of this Board from 1856 till his death. He was an editor of *The New York Evangelist* from Nov. 1869–Sept. 1870. He was a trustee of Princeton College from 1861 till his death. He received the honorary degree of D.D. from his *alma mater* in 1860. He married, May 5, 1841, in Phila., Pa., Miss Elizabeth Miller, who died May 4, 1891. Two sons and one daughter survive him.

ORIGINAL CONTRIBUTIONS.

GERMAN SLANG.*

By H. C. O. HUSS.

Slang is the name of the "naughty boy" in the great family of the English language. He knows no restraint, never keeps straight, is impulsive, unruly, unmannerly and, at times, untidy. Like the *enfant terrible*, yet without its disarming innocence

and ingenuousness, he occasionally will shock and scandalize whole parties by his blunt and blundering outspokenness. Therefore, on all extraordinary occasions, for instance when distinguished strangers are being entertained in the house, Master Slang is considered unornamental, and kept under key in the nursery.

But the same child is so full of life and spirit, so healthy and vigorous, so sprightly and witty, so spontaneous and genuine,

* *Deutsches Slang. Eine Sammlung familiärer Ausdrücke und Redensarten zusammengestellt von Arnold Genthe. Strassburg. Verlag von K. I. Trübner, 1892.*

so amusing and refreshing—in a word so indispensable to all, that as soon as the last guest has taken his departure, the little bright-eyed urchin is set at large again, and there he is the very next moment capering and rollicking and gamboling from room to room, from story to story, taking possession of the entire house, and ruling supreme as before.

The German language, too, has her naughty boy, and heaven knows what a spoiled child *he* is; yet—strange to say—he has not been christened as yet, although he is by no means a stammering baby any longer, and, most likely, never was, and so he has of late been introduced to the public by his interpreter, Mr. A. Genthe, by the borrowed name of the “*Deutsche Slang*.”

Mr. Genthe's book contains an introduction on German slang, and a vocabulary of one thousand and a half slang terms, viz., familiar expressions that, he assures us, have exceeded provincial limits and acquired currency in society all over Germany. Each of them is rendered by its literary equivalent, and many are illustrated, moreover, by an appropriate sentence.

Though far from claiming completeness—all technical and professional as well as all obscene or otherwise objectionable terms are omitted—this slang vocabulary must, at home and abroad, be considered as a valuable contribution to German lexicography: At home, in every case where a native writer, wishing to use a slang term, is doubtful as to its catholicity, viz., whether it is general or merely provincial; and abroad, each time the stranger is reading German comedy or other comic writings; for slang abounds in these, but the ordinary dictionaries are reticent about it. And even more indispensable is a slang vocabulary to the foreigner who is learning German among the Germans at home. For the familiar conversation of

even the most cultivated classes of society is hardly ever entirely free from slang, while that of the average German is brimful of it. The foreigner, therefore, to guard against mistakes and unpleasant slips, needs an experienced guide that will correctly label for him as either “literary” or “slang” each word he hears used for the first time—in other words, he needs a slang vocabulary.

The usefulness of Mr. Genthe's book is therefore unquestionable, and we feel confident that it will prove a reliable interpreter and a safe guide to everybody who entrusts himself to its guidance.

OBSERVATIONS OF NOVA AURIGAE.

By TAYLOR REED.

The spectrum of Nova Aurigae was first observed on Saturday, Feb. 6, with a single-prism spectroscope on the 23 inch equatorial. No cylindrical lens was used. It clouded up before any measures could be made. C was very bright; D distinct. There were two luminous knots between C and D, and one strongly suspected a short distance from C toward the red. Near b, and toward the red four were easily seen, and between b and F two more. H γ (near G) was obvious, and a much fainter line was seen one-third way from G to F. In all, thirteen bright lines were seen between C and G, inclusive, and one suspected below C.

On Friday, Feb. 12, some measures of the position of the bright lines in the spectrum were made, with a single-prism spectroscope with scale and occulting bar on the 9½ inch equatorial. The constants of the scale were determined from the spectrum of the moon. Ten lines were measured, giving the following wave lengths: 434 (H γ), 486 (F), 493, 501, 516, 531, 559, 580 (D?), 656 (C).

On Saturday, Feb. 13, an observation was obtained with the Brashear single

reflecting prism spectroscope on the 23 inch telescope. The measures were made by reading the circle carrying the prism when the spectral lines were brought to coincide with the faintly illuminated cross hairs; reference points obtained from the spectrum of the moon. The method of setting proved unsatisfactory, but gave the following results for wave-lengths of the bright lines: 486 (F), 492, 502, 515, 530, 591 (D?), 631, 656 (C).

The same evening the spectrum was examined with a Rowland grating, to determine whether the lines were true lines, or bands sharp at the more refrangible edge and fading out toward the red. They were found really to be lines, broad, such as are given by hydrogen under considerable pressure, the shading being symmetrical. The two lines nearest F seemed to be multiple, but on account of the faintness of the spectrum the slit could not be closed enough to determine.

On Monday, Feb. 15, the single reflecting prism spectroscope was again used on the 23 inch telescope. This time the prism was firmly clamped and the settings were made in a single field of view from F to a point some distance below E by moving illuminated wires by a micrometer at the eye-piece. The points of reference were derived from the spectra of the moon and of the nebula of Orion. Six lines were observed, giving for wave lengths 4861 (F), 4922, 5015, 5165, 5260, 5304. The probable error is a unit or two in the last place.

Three of the lines seem without doubt to be C, F, and H γ . The line in the yellow is not D $_3$, but is nearer D. A careful comparison with the spectrum of the nebula of Orion shows that the two brightest nebula lines are not present in the spectrum of the new star. The line at 5304 is probably not the coronaline (5316).

On Feb. 13 there was an extremely red and bright aurora. With a single prism

spectroscope with a scale it was possible to determine the position of the two lines in the red and yellow: the constants of the scale were derived from the spectrum of the moon. It is a very striking fact that the measures place two bright lines in the spectrum of the star in nearly the same position; so near that they may be the same; star 631 and 559; aurora 634 and 557.

On Feb. 6 the star was estimated to be a quarter of a magnitude brighter than χ Aurigae; on Feb. 15 a quarter of a magnitude fainter.

The position of the new star was determined by six observations with the meridian circle. The object of reference was β Tauri, whose place was taken from the Berlin Jahrbuch. The observations are reduced to 1892.0.

	1892	α	1892.0	δ	1892.0
Feb. 9	5 ^h 25 ^m	3.23	+	30° 21'	48."7
10		3.30			50. 5
11		3.27			48. 3
12		3.36			48. 7
15		3.29			49. 9
16		3.34			49. 3
Mean	5 ^h 25 ^m	3.30	+	30° 21'	49."2

NOTE ON A QUALITATIVE TEST FOR CHROMIUM.

By L. W. McCAY.

In most works on qualitative analysis it is directed that an insoluble chromate† or a mixture of ferric, aluminic and chromic oxides be tested for chromium by fusing the chromate or mixture with sodium carbonate and nitrate, treating the fused mass with water, filtering and adding acid to the yellow filtrate. This addition of acid is said to change the yellow color of the filtrate to a reddish yellow—change—

† Fresenius' Qualitative Analyse. Vierzehnte Auflage, §133, 10. Under chromic oxide, however, §102, 8, he says that potassium chlorate serves the purpose better than the nitrate. No reason for this substitution is given.

ing the neutral salt to an acid salt. This would of course be true were there after the fusion no reducing agent present in the melted mass. There is, however, formed during the fusion a considerable quantity of alkali nitrate which dissolves with the chromate and which, upon the addition of acid to the filtrate from the insoluble residue, splits up into a corresponding alkali salt and free nitrous acid. This nitrous acid is often present in such quantities as to almost immediately (especially when the liquid is heated) reduce

all the chromic acid to chromic oxide and occasion a grayish blue solution *which can completely mislead the beginner*. I venture to call attention to this point, which I insist is of sufficient significance to warrant mention, at least in such a standard work as that of Fresenius. It is but proper to add that in the Quantitative Analysis of both Rose and Fresenius, the reducing action of the nitrous acid is mentioned, but, in Rose, with what seems to me scarcely a sufficient amount of prominence.

SUMMARIES OF PAPERS READ BEFORE SCIENTIFIC SOCIETIES.

THE MATERIAL ASPECT OF LOGICAL FORMS.

By A. T. ORMOND.

The Kantian School of logicians, whose leading exponent among English thinkers is Sir Wm. Hamilton, define and treat Logic as a pure science of the a priori forms of thought. Their assumption is that thought has pure forms unmodified by matter.

Now, conceding that Logic is concerned primarily with thought and its laws, the fact remains that it is of the essence of thought to deal with matter; it is thought about something. Thought not about anything does not exist. This being admitted, it follows that thought either thinks about things as they are, or, as they are not. In one case thought is *knowledge*, in the other *illusion*. The objective categories of thinking are, therefore, knowledge and illusion.

All knowledge is divisible into knowledge of *fact* and knowledge of *relation*. Thought-knowledge belongs to the latter category. Relations constitute its differentia. Of thought-knowledge there are two species: Metaphysical, which embraces

those first relations or axiomatic assumptions which underlie all science, and Logical, which proceeds upon metaphysical and perceptual data to truths which are arrived at by a process. This process involves abstraction and inference, and is called *discursive*. Its product is discursive knowledge. This discursive process is the subject-matter of Logic, which is, therefore, a science of the forms of knowledge and not of the mere forms of thought. It may accordingly be defined as that science which has for its aim the development of the laws of discursive knowledge.

Treating as it does of the *process* of knowledge, all Logic is *formal*, and treating, as it does, of the process of *knowledge*, all Logic is also *material*. The only fundamental division of the science, so far as I can see, is into *Pure* and *Applied*, the former being analytic and unfolding the principles of the discursive procedure; the latter, synthetic and constructive, and treating of method. Logic is further divisible into General and Special branches, according as its principles are applied to matter in general or to special kinds of matter. Combining the above distinctions, the following scheme emerges:

Logic	{ Pure,	{ General.
		{ Special.
	{ Applied.	{ General.
		{ Special.

Among the data of Logic are certain relations and processes. The fundamental logical relations are Identity and Difference. Plato calls them the *same* and the *other*, and in his mythical account of the composition of the soul regards them as primary ingredients of reason. These categories underlie all logical processes. Their first and most abstract expression is in the so-called fundamental laws of thought, Identity and Contradiction. The traditional reverence with which these laws are generally regarded has called down on them the scorn of such philosophers as Locke, who classes them as trifling propositions, and avers that men might keep on repeating the formula *a is a* to all eternity, without making any startling additions to the sum of knowledge. Locke's ridicule is merited, but it is irrelevant. The laws of thought are nothing more than formal statements of omnipresent motives of logical thinking. They are abstract formulations of constitutional tendencies. It is man's nature, as a rational creature, to be ever looking for the same and the different. The categories of Identity and Difference are the *fontes et origines* of all logical forms and their initial out-put are the laws of identity and contradiction.

The logical categories and the laws of identity and contradiction have their real value as primary and pervading motives of the discursive processes. Certain of these processes may be treated as data of Logic, rather than as part of its content. Experience presents, as Mr. Hodgson shows, two orders, the *perceptual* and the *conceptual*. The former is composed of things in the concrete with relations coiled up in their bosom. The conceptual order presents things in the abstract and general, with the relational elements drawn out and rendered explicit.

The transition to this species of knowledge presupposes certain psychological endowments, such as the ability to analyze concrete masses, and to concentrate attention upon special points. The first overt acts of discussion will doubtless be of the exclamatory sort, taking the form of, ah! what! ah! here again! as the mind follows hot on the trail of some identity, through the wilderness of differences. Difference at first will serve merely as a species of foil to identity, achieving the dignity of a positive agent only when the mind runs on some *crux*. Two things that at first blush, are indiscernable, cross the mental path. We say, ah! this! no, this! and the check which has been given to progress is at length broken with the, not that! but this!

This is *abstraction*. Its obverse side is *generalization*, the marshalling of individuals under the abstract *view-points* called genera and species. The abstracting and generalizing activity is thus the bridge over which the mind passes from perceptual to conceptual knowledge. Now, the point which is meant to be emphasized here is that this function of abstraction and generalization does not, as Locke imagined, break the connection of thought with reality. Conceptions of genera and species are *thoughts about things*. Their notional content is a material reference which, if cut off, leaves them absolutely bereft of meaning.

Having thus achieved the basis of discursive knowledge, the logical functions involved in its development are *Judgment* and *Inference*. Logical judgment as distinguished from Psychological, is ordinarily defined by the formal logicians as an assertion of agreement or difference between two notions. It is clear, however, that the question of relations among mere notions is one for Psychology and not for Logic. A logical judgment is objective, and effects a *synthesis* or *diremption* in the matter about which the notion thinks.

The immediate stuff with which it deals are certain objective relations which the process of abstraction has brought to light. We may call these relations *ontological* to distinguish them from the logical categories of identity and difference, and a logical judgment may be regarded as a function which effects a synthesis or diremption of things with respect to their ontological relations. The following will illustrate the synthetic function: Caesar conquered all Gaul—*active property*. Every man has his foibles—*possession*. A thief ought to be punished—*moral or legal desert*. $36=6$ times 6 —*equality*. The diremptive function will be exemplified in the following: A Catholic does not eat meat on Friday; Peter is not a brother of James; innocent men ought not to be punished. Invariably in every logical judgment, whether synthetic or diremptive, an ontological relation is thus involved.

It is interesting to observe how, from Aristotle down, these ontological relations have been disposed of by packing them in with the predicate. Thus, John flatters his rich uncle, is metamorphosed into John is the flatterer of his rich uncle. The device seems necessary in order to reduce judgments in general to tractable form. But it turns them inside out and gives them the ridiculous air of vertebrates who should insist on wearing their skeletons outside. Not only so, but it has produced a monstrous illusion among logicians, leading them to regard the copular relation as an *a priori* thought-form which is independent of variations of content. Such a view is contradicted by the facts. The thought-forms of judgments are constantly changing and their variations are determined by the nature of their material content. To make this clear, it is only necessary to classify judgments according to the material distinctions of quantity and quality. The resulting species will be:

2. Equational judgments of Quality.
3. Partly quantified judgments of Quality.
4. Pure Qualitative judgments.

The mathematical equation, the completely quantified judgment of Symbolic Logic, the ordinary generic judgment with its quantified subject, and the attributive judgment which effects a purely qualitative synthesis between attributes, will serve respectively as illustrations of these forms, and they give rise to four different species of copular relation, Equality, Equivalence, Inclusion and Affinity.

That these variations are caused by differences of content is clear. But the mode of their determination may not be so manifest. They arise from the reaction of the ontological relations which have been packed into the predicate, upon the copular relation. When we say $x + y$ is the equal of z , we seem to have neatly disposed of the quantitative relation and secured a purely formal judgment. But we are mistaken. *Equal of* reacts upon *is* and gives it a material import which will make itself felt when the inferential value of the judgment comes to be tested. The like is true in all cases. Invariably the copula is modified by the ontological relation involved in the judgment.

Inference is a function which unfolds the *implicates* and *disparates* of judgments. The logical categories of identity and difference pervade inference as they pervade judgment, determining its affirmative and negative forms. But the limits of inference are everywhere materially determined. That this is true of both immediate and mediate inference could readily be shown by a brief analysis. Avoiding details,* the fact with reference to immediate inference may be stated as follows: If the four species of judgments developed above, be taken and submitted to the various devices which logicians have worked out for unfolding immediate

* Details are given in the paper from which this abstract was taken.

implications, it will be found that the inferential power of each species is a function of its material character.

Mediate inference has as its basis two judgments, with one notional content in common, which is so related to the contents of the other two notions as to render a judgment respecting their relation possible. Mediate inference may be symbolically represented as follows: a is b ; b is c , $\therefore a$ is c , *is* standing simply for formal agreement of terms. If this formal agreement were all that the judgments contemplate, no variations of copula could arise. But the character of the ontological relations which connect the terms must also be taken into account. Let a be a *kind* of b and b the *equal* of c ; no relation can be asserted between a and c . Mediate inference involves ontological as well as logical agreement. The law is without exception that material identity of the ontological relations asserted in the premisses, must underlie the merely formal agreement expressed by the logical copula, before any inference can be drawn.

It will be found that mediate inferences may be classified into four species corresponding to the four forms of judgment developed above. These may be characterized as follows: 1. *Quanto-Quantitative*, or quantitative reasoning about quantity which employs the pure mathematical judgment; 2. *Quale-Quantitative*, or quantitative reasoning about quality which employs the quantified logical judgment or equation of quality; 3. *Quanto-Qualitative*, or partially quantitative reasoning about quality, which employs the ordinary generic judgment; 4. *Pure Qualitative*, or qualitative reasoning about quality, which makes use of the attributal judgment.

Out of these varieties of inference-forms, three well marked types of reasoning arise; which, in view of their difference, may be styled *Calculative*, *Subsumptive* and *Generalizing*. The Calcula-

tive type dominates in pure quantity. It is mathematical and has two species, Geometrical and Arithmetical. The Subsumptive type dominates in all reasoning which employs the generic judgment and in which the ideas of genus and species, and the ontological relations that connect them are prominent. Such reasoning naturally falls into the forms of the figured syllogism and furnishes the staple of ordinary Formal Logic. The Generalizing type dominates pure induction where inference is qualitative and follows the trail of particulars in its search for general laws. This type has at least two sub-species, the Analytical and the Analogical, which Bosanquet elaborates in his great book.*

If now we combine the Calculative and Subsumptive types we obtain a modified form which dominates what may be called Qualitative Mathematics or Calculus of Quality. This mixed type employs the species of inference called *Quale-Quantitative*, and its favorite judgment is the Equation of Quality. The branch of Logic which appropriates this type is called *Symbolic*, and may be briefly characterized as the application of the symbols and operation of quantity to qualitative matter. Analysis will show that all the distinctive features of the Calculus of Quality arise from the reaction of qualitative matter upon quantitative forms. Like the Platonic $\epsilon\lambda\gamma$, quality is found to be in a measure recalcitrant to the forms of quantity, and the result is a compromise which may be regarded as either a modified Logic or Mathematic.

The fact, noticed above, that in ordinary logical practice the ontological relations are packed into the predicate of judgments has led in modern times to an attempt to develop a Logic which shall deal directly with these relations. This attempt

* Logic, Vol. II, Chap. III & IV.

is made in what De Morgan calls the *Logic of Relatives*. Take for example the eight species of relations noted in Dr. McCosh's tables,* making any additions which may be found necessary; the problem is to reduce these relations to the fewest possible distinct types and to develop a Calculus for their logical use. Such a Calculus, if practicable, would enlarge the sphere of Logic and render it in some degree commensurate to the richness and complexity of actual reasoning. But it involves enormous difficulties, and the enterprise may be Quixotic.† Failure here would, however, only emphasize the contention of this paper by showing that the material modifications of logical forms reach even beyond calculation.

The problem of Special Logic is somewhat analogous to that of the Logic of Relatives; namely, to develop canons of reasoning for the special sciences. The efforts hitherto made in this direction have not been eminently successful. Special, like General Logic, has its analytic and constructive branches which require distinct development. The tendency has been to regard the problem of Special Logic as one purely of method. This is a mistake. Each science requires its modified forms of inference as well as its special method. The specialist who passes from one science to another, say from Biology to Politics, finds it necessary not only to adapt his method to the new class of phenomena which confronts him,

but also to master a new set of ontological relations and shape his reasoning accordingly. This latter task is the more essential of the two, for while forms of inference possess a universality, which is due to the fact that all reasoning is ultimately one; they, on the other hand, take shape from what they feed on, and in order to reason correctly and with power in any given sphere it is necessary to master the form as modified by the content.

[Abstract of paper read before the Philosophical Club, Jan. 13, 1892.]

THE HUGUENOTS AND THE BEGGARS.

By PAUL VANDYKE.

The reformation was not a sudden disturbance spreading from a centre in ever-widening circles. It was a general movement of the human soul finding expression in different localities and varying into diverse types.

These may be classified under three heads, Radical Reform, National Reform, Catholic Reform.

The Radical Reform embraces all those movements which, like Socinianism, broke with the dogma of the church; or like the anabaptists, with dogma, the ideal of religion and the politico-religious ideal of society. The National Reform embraces those movements which did not break with ecumenical dogma, or the politico-religious ideal of society, but with certain ideals of religion as expressed in organization, traditions and cult.

The Catholic Reform has its centre in the Oratory of Divine Love and its characteristic movements of expression in the council of Trent and the Society of Jesus.

The history of Europe from 1500 to 1650 is the history of this movement and the variations of its types.

The National Reform found simultaneous expression in Germany, France and

* Psychology, Vol. 1. The Cognitive Powers, p. 211.

† Venn. Symbolic Logic, p. 404. Quotes the following Classification of Relations by Mr. J. J. Murphy. Relations may be classed:

a. As transitive or intransitive
b. As invertible or uninvertible.
This will give:

1. Transitive and invertible.
2. Transitive and uninvertible.
3. Intransitive and invertible.
4. Intransitive and uninvertible.

The first will include equality, brotherhood, &c.; the second, inclusion, causation, sequence, greater magnitude, &c.; the third, exclusion and difference, &c.; the fourth, the great majority of relations. Venn thinks the classification sound, but does not think it will add much to the province of Logic.

Switzerland. It entered almost at once on a fight for life—lasting for four generations and divisible into three great stages. In the first stage Lutheranism was the protagonist, the Empire the foe. It was ended in 1555 by the peace of Augsburg, in which Lutheranism achieved independence. The Empire retired from the struggle. The church found a new champion in the Catholic Reform, with Loyola for its Luther and Spain for its protagonist. The National Reform found also a new protagonist in the French Reform, which, under John Calvin, established itself at Geneva and absorbed the Swiss type. From that central angle it spread over the sector of a circle roughly indicated by the Alps, the Pyrenees and the Ocean.

In Holland and France the Genevan propaganda established two churches, which soon became secret religious republics. They had a common foe, Spain and the Catholic Reform,—they found for their dictators two men alike in their greatness, their ideals and their fate, Gaspard de Coligny, the Great Huguenot, William of Orange, the Great Beggar—the treaty between these two—The services of Orange's brother to the Huguenots—The organization of the Beggar fleet borrowed from Coligny by Orange.

Coligny and Orange elaborate the plan of a colonist league, with France at its head, guaranteeing the mutual toleration of Calvinist and Catholic, and breaking the tyranny of Spain—The influence of this idea in European history as used by the pupil of Coligny and the descendant of Coligny and Orange to build up national greatness and oppose national supremacy—Its first realization prevented by the vanity and cowardice of two women—The massacre of St. Bartholomew drives Huguenot and Beggar to the last ditch—They rise to meet a new antagonist in the Holy League.

It assassinates Orange and he dies in the arms of his wife, the daughter of Coligny—The noble women of the Reformation who taught their men to live for duty—For this great struggle was animated by a great passion—a protest against certain methods of treating the Reformation history—The great forces of history elemental—This struggle animated by religious belief—An unconscious struggle for the freedom of religion—Calvinism the most flexible of all the types of National Reform—In the end of the eighteenth century it alone joined hands with the Renaissance in France and America to establish a free church in a free state. In that freedom, grateful for the past but unfettered by it, we may speak frankly of the limitations and the heroism of the fathers.

[Abstract of an address delivered before the Huguenot Society of America.]

GNOSTICISM.

By PAUL VAN DYKE.

The beginning of Gnosticism is in the transition period between the Apostolic and Post Apostolic times, which is the most obscure in the history of Christianity. Of its origin we have no account, and its remains seem like Eastern ruins, gigantic, grotesque, meaningless.

This impression is caused not by its ideas but by its forms of expression. For it is filled with ideas false but intelligible and influential—some of these indicated.

The dominant tendencies of thought in the age when Gnosticism arose were metaphysical and mythological, unbalanced by any corresponding development of the scientific and critical. Hence there was a constant tendency to project and fix speculations into metaphysical abstractions and mythologic beings, whose existence was accepted without being very much believed in. That state of

mind which could hang half way between the conception of such an abstract or being, and a conviction of its existence, is unknown to us. We believe things to be either symbols or realities, but the Gnostic mind did not draw sharp distinctions between symbols and realities; they confounded both with thoughts.

It was an age of intercourse and assimilation. The nations of the Mediterranean were becoming a Romania. None of the old natural religions could furnish for this new world a faith and cult. So there appeared a tendency to religious syncretism. Men tried to make, out of the fragments of the old, a new religion. Their chief centres of influence conditioned this process,—the writings of the Jews, the philosophy of Greece and the mythological cults of the East.

The fathers name Simon Magus as the father of Gnosticism—Reasons for doubting this opinion. Probably before Christ was preached some elements of Gnosticism were forming strange mixtures ready to seize on such portions of Christianity as they could assimilate. Classification of Gnosticism—its greatest systems Alexandrian—Alexandria was a type of the Mediterranean world. The mother of great syncretic systems,—Philonism, Origenism, neo-Platonism. In this favorable atmosphere Gnosticism had its most flourishing growth. An account of the two systems of Basilides and Valentinus—typical of Gnosticism.

It is difficult to form a distinct idea of just what it is in any system which makes it Gnostic. It helps us in this to remember that Gnosticism was a perversion of Christianity—a heresy and not a philosophy. In its best forms Gnosticism was not a speculation, but a religion. It strove to save men by knowledge (*gnosis*). For the highest power of man was thought and the best name of God was not love but pure intellectuality dis severed from all ex-

pression in action or existence. They lacked the spirit of the little child who inherits the Kingdom of Heaven. So they divided men into classes. Their gospel was not whosoever will but whosoever can. Trying to make a philosophy of religion they ended by making a religion of philosophy. The problem with which this philosophy was exercised was the relation of evil to God and in all systems it reached the same result that matter was evil.

This enables us to form a fuller definition of Gnosticism. For as it would be a poor definition of Christianity to call it a philosophy of the relation of God to man, so it is an insufficient definition of Gnosticism, whose aims were practical, to call it a philosophy of religion. The tests of the comparative value of religions, the ideals they propose and the influence they exert on life. (All religions *claim* truth.) Gnosticism, which in its bloom in Alexandria was an attempt of Greek philosophy to absorb Christianity, was in its most general characteristics an exaltation of the intellectual as the most divine in man, and the inculcation of the consequent duty of the contemplative life.

It was the perception of that practical dualism, which every man knows in his own nature, which inclined them to adopt their theoretical dualism and their division of men into classes. They divided their own natures by calling that which God had created unclean. They destroyed the universal brotherhood of man by cutting the bonds which bind us all into a common humanity.

Gnostic Christianity was a false Christianity. Its theology destroyed the incarnation. Its morals substituted self-consciousness for love. Its religion put *gnosis* in the place of *pistis*.

[Abstract of a paper read before the Philosophical Club.]

A FEW OBSERVATIONS UPON YOUNG RATTLESNAKES.

By C. F. W. McCLEURE.

On September 23, 1891, a female rattlesnake (*CROTALUS LUCIFER*) in the writer's possession gave birth to seven young ones, two of which were still born. The snakes at time of birth measured 8½ inches in length and each, including those that were still born, had a flattened oval button at its distal extremity.

Observations made upon the two still born snakes, one of which was connected with a considerable mass of yolk, which in the other had entirely disappeared, revealed the following points:

1. That in each the poison glands, ducts and fangs were present, the latter being delicate needle-like structures about one-tenth of an inch in length.

2. The presence of poison glands, ducts and fangs immediately suggested the possibility that venom might be secreted by the gland cells at this early date, but a series of inoculations on pigeons, with carefully prepared abstracts of the gland substance, produced none of the lesions or symptoms so characteristic of Crotaline poisoning.

Observations made upon the live snakes showed:

1. That the button did not assume its characteristic adult form till after the second sloughing, which occurred on an average three weeks after birth, then a new element, similar in form to the rattles or rings, which are formed later, and which are so characteristic of the adult animal, was added to the proximal end of the oval shaped embryonic button and firmly joined to it, giving the structure its adult form, which may be likened to that of an acorn.

2. That in all probability the poison glands become functionally active as soon as the snakes begin to shift for themselves, which must be very soon after birth. Experiments on the young ones six days after birth proved the presence of venom in small quantities. Experiments made three months after birth showed that considerable venom is secreted, as a pigeon, inoculated at this time, died in two hours with the usual symptoms of chronic poisoning.

—
[Abstract of paper read at Philadelphia before the American Society of Naturalists, December 29th, 1891.]

SUMMARIES OF PAPERS PUBLISHED.

CHRISTIANITY AND SOCIAL PROBLEMS.

By CHARLES A. AIKEN.

Social problems are dividing public interest with Biblical problems. They are being discussed by societies and by distinguished individuals; are handled in the newspaper and made the theme of the popular novel. The Christian Church must take part in this discussion, as the special champion of the vital connection of religion with morality and with the right understanding of the duties of man to man.

Our time is not favorable to a wise and candid treatment of these social questions. The prevalent unrest and dissatisfaction makes it difficult to exercise a calm judgment in them. The Church and the world are both affected by the temper of the times, and confront the same questions from different standpoints, with much the same uncertainty of view and the same indefiniteness of purpose.

The Church cannot be content with things as they now are; nor can it exonerate itself from all responsibility and hold the gospel and other agencies responsible

for the slow and partial triumph of Christianity in the social life of the earth. As in other relations, so in the sphere of social relations, the Church is disquieted by the apparently slight influence which it is wielding in the settlement of pressing problems. The strife in the world is growing hotter; all along the line assaults are being forced against the present social order; and the philosopher, who looks on human society as a phenomenon which is beyond the control of human volition, unites with the desperate nihilist, who has abandoned the hope of improvement without destruction, to warn off those who would try to amend the present state of things.

The Church must however see clearly that in the present conflict it has a duty to perform and certain offices to fulfill. These offices are a *conservative*, a *reformatory* and a *mediating* office.

The Church is to be conservative of the position assigned her in the world. She must maintain the place she has been given to occupy; she must not go out to find new duties or a new field of labor. Her place is appointed and she must hold it to the end.

The Church is to be conservative, moreover, of the instructions given her. She must go out into the world without fear of contamination to do the work that has been given her to do. Where the letter of her instructions is not at once clear, and she seeks to decide by reference to their spirit, she must be careful lest any other spirit may mingle with and vitiate the spirit of the divine orders under which alone she has a warrant to act.

The Church must be conservative of the doctrine which she is to proclaim. In the sphere of social science her principles are these: The reality and efficiency and rightful supremacy of moral and spiritual entities and forces; the reality and the transcendent importance of moral and spiritual interests; the maintenance of a due

proportion and a right relation of things material to things spiritual; and therefore, of course, the supremacy of God and things divine; the uncompromising assertion of the reality and the authoritative nature of God's revelations of Himself in His Son and in His written Word; the dignity of manhood, in the assertion and exposition of which the Church has a witness to bear, which, whatever the appearance, is higher in fact and more far reaching in significance and bearing than the most pretentious and delusive offer ever made by the great tempter to our first parents, or by modern philosophy to its adherents; the divine order and constitution of humanity and of society; the true mutual relations of the present life and the life to come; the truth that here "man's life consisteth not in the abundance of the things which he possesseth," while yet possession is no proof of extortion, usurpation or fraud; the great principle in the divine economy, whose importance is indicated to the Church by the fact that her Lord took occasion so often to reaffirm it, that "who-soever hath, to him shall be given, and he shall have abundance, but whosoever hath not, from him shall be taken away even that which he hath"—a principle so utterly opposed to the communistic tenet that "to him that hath not shall be given, and from him that hath shall be taken away that which he hath;" the principle that there are distinctions—natural and circumstantial—in essence, in power, in possibility, in right, not to be obliterated, because they owe their existence to the creative and providential orderings of God, so that to enter, as much modern revolutionism does, upon a war of extermination against them, is to join issue with God; the principle that the second table of the divine law, the second great commandment, upon which many without and some within the Church would concentrate an all but exclusive attention, can never be

duly honored or fulfilled, except in its secondary relation to the first; the grand principle of the dignity and blessedness of honest, earnest toil; the law of increase and conquest in many of the most important departments and relations of life, that losing is finding, that sacrifice is acquisition, that submission is ascendancy, that surrender is triumph. These are social truths and principles of the first magnitude, and their special relevancy to the social needs of our time needs no proof.

The Church has a reformatory office. It is its duty not to be blindly conservative; but to hold fast to its principles and seek to apply them to remedy the various evils of the world. Its concern is with salvation, and this salvation is not personal only but includes the transfiguration of society. It attacks moral evil, wherever found, and trusts that social reforms will follow in the wake of moral revival. It does not quarrel with the constitution of things, with social inequalities, poverty and sorrow, conflict and suffering. But it alleviates the misery, and removes the sting of inequality by the exercise of that charity which is its crowning glory.

The Church has, lastly, a mediating office. It does not take part as an arbiter in the strifes of men. But by infusing into them a recognition of the brotherhood of man, the binding obligation of the Golden Rule, the relative importance and proper order of duties and rights; by subordinating material ends to spiritual progress; by vigorously endeavoring to alleviate evils, the Church may mediate actively in the affairs of human society.

[Abstract of a paper published in the *Presbyterian and Reformed Review*, Jan., 1892.]

ANDREA DELLA ROBBIA'S ASSUMPTION OF THE VIRGIN IN THE METROPOLITAN MUSEUM OF ART.

By ALLAN MARQUAND.

This beautiful altar-piece came into the possession of the museum in 1882. It

was purchased through the late James Jackson Jarves, and is said to have once adorned the private chapel of the Prince of Piombino. It was attributed to Luca Della Robbia, (1400-1482).

A careful study of the monument shows that at least three of the principal heads are modern; the head of the Virgin and of the three monkish saints. The quality of the glaze and the technical execution of these parts differ in a marked manner from the rest of the monument. But, fortunately, other very similar works in and near Arezzo enable us to restore the lost heads with perfect security. These strictly analogous monuments may be proven to be the workmanship of Andrea Della Robbia (1435-1525), the nephew of Luca. He made many altar-pieces, and he and his son Giovanni represented the Assumption of the Virgin many times. Whereas we cannot with certainty attribute to Luca a single altar-piece nor even a representation of the Assumption. This monument shows all the characteristics of Andrea's style, and may be dated with strong probability within the limits of the decade 1479-1489, that is, after Luca's death and when Giovanni was still a very young man.

The standing figures represent S. Donatus, first Bishop of Arezzo, S. Francis, S. Bernard of Siena, and a fourth saint, possibly S. Antony of Padua. All of these saints were associated with Arezzo and its immediate neighborhood. Consequently we may assume that the altar-piece was made for some church or monastery in this district. The presence of three Franciscan monks suggests that it was originally executed for the Franciscans, who were strong in this part of Italy. The fact that the heads which have been removed are the heads of all the Franciscan monks, and the head of the Virgin (the doctrine of the Assumption was strongly supported by the Franciscans), coupled with the fact that other

similar monuments about Arezzo have remained intact, suggests the hypothesis that the injury to this altar-piece was inflicted after its removal from this region and was inspired by anti-Franciscan and anti-Assumption feeling.

[Abstract of a paper in the *American Journal of Archaeology*, Vol. VII, No 4, Sept., 1891.]

TWO EARLY GOTHIC MONUMENTS IN ITALY.

By A. L. FROTHINGHAM, JR.

The two monuments here studied are the monastic churches of Chiaravalle di Castagnola near Jesi in the Marches of Ancona, and of Arabona near Chieti in the Abruzzi. Both belonged to the Cistercian order, and illustrate respectively the early and the middle phases of the introduction of Gothic architecture from France into Italy.

CASTAGNOLA is the earliest of the entire series of such churches, having been commenced in 1172, according to an inscription in the porch, and finished in 1196, as shown by another inscription in the apse. This monastery was founded from Locedio in Piedmont, not far from Vercelli, whose monks came from La Ferté. Consequently its architecture is tinged with the Lombard style, especially in its exterior. The interior is more purely French, because based upon the new system of the pointed ribbed cross-vault. The style of this interior is very like that of some churches of the Ile-de-France built between 1130 and 1140, just before St. Denis. Its vaults are provided with wall ribs, and the arches of the nave are pointed. The thrust is neutralised on the outside by buttresses, which rise above the roof of the side-aisles, and which, though at present solid, appear originally to have been flying: this is indisputably the case with the buttress next to the transept. The earliest examples of the flying buttress are in France, and date from about 1140 or a little after. The ribs of the vaults

are formed of a simple torus moulding, such as was in general use in France until after 1140. The ground-plan is of the usual Cistercian pattern: a cross with square apse, and two square flanking chapels on each side. The exterior is characterised by a five-arched porch, similar to that at the Abbey of Pontigny in Burgundy (1150) and by a fine wheel-window, with twelve radiating colonnettes, connected by round arches. All the windows and doors are round-headed. The church is built entirely of brick, another indication of Lombard influence, because the French Cistercians used stone whenever possible. For this reason we do not find the usual early Gothic foliated capitals: they are simply cubiform. The outline of the facade is Lombard: it is in the form of an unbroken gable, rising screen-like above the roof, and broken in the centre by a two-light round-headed window. The monastery to which this church was attached has been entirely destroyed. We are inclined to regard the church as earlier by a few years than that of Fossanova, and as belonging to a different section of the new style, less pure, perhaps, but more advanced in its use of the vaulting system and buttresses.

ARABONA, or S. Maria di Arbona, is slightly later in date, though not consistently more advanced in style. It is closer in style to the Fossanova group than to Castagnola, and has evidences of the influence of a school of Cistercian architects connected with SS. Vincenzo ed Anastasio in Rome. This influence is shown in the grand round arches of the nave, only one of which remains, the rest having been gradually destroyed since the monastery was abandoned at some time since the XIV century: less than fifty years ago, when Schulz visited the monument, a second arch existed. Since then their vaults fell in and only one could be repaired. The date of the building is 1208, when Cistercian monks entered the monastery from SS. Vin-

cenzo ed Anastasio. The church is grandiose in style and impressive in its interior, from the loftiness and width of its main vaults, the breadth and simplicity of its details and the beauty of its proportions. The vaults are all pointed and ribbed cross-vaults and in their treatment in the nave, transept and apse the architect showed boldness: they are constructed, apparently, of brick. The arches are pointed, except in the nave: the windows are round except one in the apse. The capitals show a gradual transformation from the earlier ones in the semi-Lombard style to the Gothic foliage of those in the apse and transept, but this and other signs point not to two distinct periods in the construction but to a development in style during the progress of the work, caused probably by the continuous relations with France, which enabled the Cistercian artists in Italy to follow the progress made in their mother country. The ground-plan was like that of Fossanova, which it nearly approaches in size, and it originally must have had seven bays in the nave. The material used is travertine and local stone except for the vaults, which are of brick. The workmanship is so thoroughly French not only in its conception but in every detail that we cannot but see the hand of French artists unaided by natives.

A small part of the adjoining monastery still remains. The wing of the quadrangle which runs southward from the church and is contemporary with it, contains a charming chapter-house, about twenty by ten metres, whose delicate cross-vaults are supported by a single delicate grouped pier similar in plan to the two heavier piers in the chapter-house of Fossanova: it is half concealed by the raising of the floor-level.

This monastery had but a short period of prosperity. It never founded any colonies, though by special gift the convent of S. Stephen *ad rivum maris* was annexed to it. In the century after it was founded

it began to decay, and it is even reported that the monks were then called back from it to the mother monastery in Rome. It had its *commenda*, as usual, with destructive results.

[Summary of two papers published in the *American Journal of Archaeology*, Vol. VII, Nos. 3 and 4.]

THE POSITION OF "ALSO," AS A TRANSLATION OF *καί* IN THE REVISED VERSION OF THE NEW TESTAMENT.

By S. STANHOPE ORRIS.

When *καί* in Greek is equivalent to "also" or "even" in English, it is *never* placed *after* but *always before* the word or phrase which it is employed to emphasize. And in view of the common translation of a passage in I Thes., it should be said that *καί*, when used in this sense, is placed not only before but *immediately* before the word or phrase which it serves to emphasize, except when the word or phrase is preceded by a preposition, in which case *καί* is placed before the preposition.

This fixed position of the adverbial *καί* in Greek should have secured for its English equivalent the proper position in the Revised Version of the New Testament. But it has not always done so, and it is to be regretted that it has not. Take the following examples: Heb. VIII. 6: "But now hath he obtained a ministry the more excellent, by how much also he is the mediator of a better covenant."

It is doubtful whether any one with a knowledge of the English only, and without direct or indirect help from one who knows the Greek, could say what office the "also" in the phrase, "by how much also," performs or should perform. But if the "also" be placed where the *καί* is placed, so as to emphasize a "better covenant" as distinguished from a "superior ministry," the passage will need no commentary: But now hath he obtained a

ministry more excellent, by as much as he is the mediator of a better covenant also (*καὶ κρείττονος διαθήκης*).

I Thes. IV. 14: "For if we believe that Jesus died and rose again, even so them also that are fallen asleep in Jesus will God bring with Him."

This language teaches that God will raise believers who are fallen asleep, if friends who survive them believe that Jesus died and rose again!

It is surprising that translators and commentators should have perpetrated and perpetuated such an error.

For the words which follow *οὕτω καὶ* in the original—that is, for the words, them

that are fallen asleep in Jesus will God bring with Him, let us substitute the word *τῶδε*—"the following," and the verse will read, "If we believe that Jesus died and rose again, so the *following* also" (*καὶ τῶδε*). The reader must feel that after "so," *πιστεύομεν* or its English equivalent is implied, and that what is said is, "If we believe that Jesus died and rose again, so we believe the following also." Hence the translation of what the apostle says is, "If we believe that Jesus died and rose again, so we believe also that those who are fallen asleep in Jesus, God will bring with Him."

[Summary of a paper published in the *Homiletic Review*, March, 1892.]

REVIEWS OF BOOKS.

HANDBOOK OF PSYCHOLOGY, "FEELING AND WILL," by James Mark Baldwin, Ph.D., Professor in University of Toronto. 8vo., pp. 387. Henry Holt & Co., 1891.

This is the companion volume to "Senses and Intellect," published three years ago. The author's aim, as stated in the preface, is to present a more adequate account of "Feeling and Will" than the general works on Psychology for the most part contain.

Introductory to the main subject, we find a comprehensive survey of the nervous system so far as physiological structure and function are related to psychological phenomena. In this sphere three laws are operative: the law of habit, resulting in diffusion of attention; the law of accommodation, resulting in concentration of attention; and the law of inheritance, according to which nervous integrations of the race are transmitted to the individual. Within this nervous mechanism the rise of consciousness occurs, presenting phases of passive, reactive and voluntary consciousness, corresponding to automatic, reflex and voluntary activity. Emphasis is put upon the unity of consciousness,

with an interesting criticism upon Dr. Maudsley's theory of the "double-brain." The primary characteristic of consciousness is sensibility, being the simple awareness of the unreflecting consciousness. Sensibility is discussed under the aspects of lower or sensuous, and higher or ideal sensibility. Under the lower we have—

A. Complete sensuous feelings, including,

(1) Common feelings, as the organic, cutaneous, muscular and nervous.

(2) Special feelings, as Sensations proper. Sensations are feelings belonging to the more highly differentiated parts of the nerve system which are provided with end organs. We find here a thorough account of the affective and presentative elements in sensation.

B. Simple sensibility, or sensuous tone. This refers to pleasure or pain as accompaniments of sensibility. Discussion of various theories follows. Prof. Baldwin's view is a synthesis of three. Pleasure is the conscious effect of that which makes for the continuance of the bodily life, or its advancement, while pain makes for its

decline or limitation. This assumes that pleasure is the result of integration, and pain of disintegration of tissue; and also that pleasure is the result of adjustment, and pain of misadjustment to environment. Ideal Feelings receive a similar mode of treatment. The analysis follows the same principle of division and is logical throughout. The ideal feelings are the modifications of Sensibility which accompany the exercise of the *apperceptive* function. We have—

A. Complex Ideal Feelings, including,

(1) Common feelings, such as follows: Interest, leading to concentration of mental activity, or an impulse to attend; Reality-feeling, accompanying a nervous process having the Sensational co-efficient; Belief, arising in consciousness through the resolution of doubt, and containing a plus element over and above reality-feeling, namely, the consciousness of the personal endorsement of reality.

(2) Special Ideal Feelings, or Emotions proper. We have emotions of activity, which accompany different phases of attentive life as feelings of adjustment, or of function; and emotions of content (having reference to objects), as presentative, carrying belief in the sensational or memory co-efficient, and relational carrying belief in the logical co-efficient. Here the most significant class is that of conceptional feelings, as those of the systematization of truth, ethical and æsthetic feelings. Underlying each of these, is an intuition that

carries reality-feeling by direct reference rather than through any constructive process. This is prominent in the author's treatment of Ethics and Æsthetics immediately following.

B. Ideal Tone. Differs from sensuous tone in having a new condition, the presence of the object in consciousness. Ideal pleasure must be defined, therefore, as the conscious effect which makes for the continuance of the *apperceptive* life or its advancement, rather than of the *bodily* life as in sensuous pleasure.

The subject of Will falls under the heads of motor aspects of sensuous feeling, and motor aspects of ideal feeling. Former surveys of field of reactive consciousness. In list of stimuli to involuntary movement, that especially characteristic and original is physiological suggestion, where, by means of extra-organic stimulus, reaction occurs unconsciously, as the reply by one asleep to questions asked. Special features treated under motor aspects of Ideal Feeling, are feeling of effort and consent, the fiat and negat of the Will, and the relation of muscular effort to attention. Discussion of Volition brings treatise to an end, with treatment of voluntary attention as choice, relations of choice to character, and Freedom of the Will.

One of the four appendices contains a valuable Bibliography of Educational Psychology. JOHN GRIER HIBBEN.

NOTES.

Preliminary examinations for higher degrees were held, according to catalogue announcement, on Wednesday, September 30th, at 2 P. M., in the Faculty Room. The following applicants appeared, and were either examined or had their examinations arranged for:

I. WITH RESIDENCE.

Mr. Clarke Benedict Williams, A.B., Princeton, 1890, for Ph.D. in Science. Chief Subject: Mathematics. Edward Waterman Evans, A.B., 1891, Princeton, for Ph.D. Chief Subject: Æsthetic Philosophy. William Post Herrick, Princeton,

A.B., 1891; Ph.D. in Science. Chief Subject: Biology. George Poste Wheeler, A. B., Princeton, 1891; Litt.D. Chief Subject: English. George Herbert Stephens, A.B. Princeton, 1891; Ph.D. Chief Subject: Mental Philosophy. Nicholas Evertson Crosby, A.B., Columbia, 1882; A.M. 1884; Instructor in Greek and Honorary Fellow at Columbia 1887-1888; Ph.D. Chief Subject: Greek. What degree.

II. WITHOUT RESIDENCE.

Lewis Buckley Semple, Instructor in Rhetoric, Lehigh University, A.B., 1884. Lehigh; Examined September 23d, 1891; Litt.D. Chief Subject: English. Alvin Davison, B.A. National College, Lebanon, Ohio, and M.A. of the same college; Ph.D. in Science. Chief Subject: Biology. Entered March 31st, 1891.

Prof. Huss has in press an annotated edition of a part of Victor Hugo's "*Les Misérables*" for the use of advanced students, and a "Collection of French Idioms" for the use of intermediate classes.

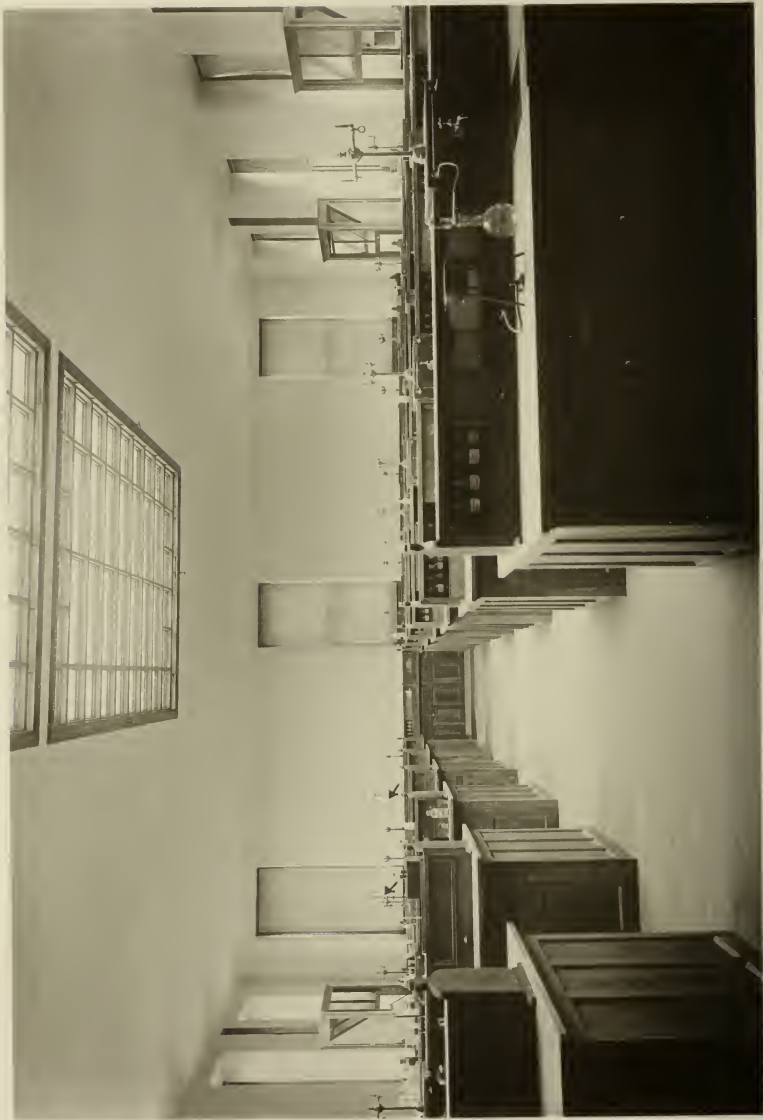
Dr. Richardson has in press, in a volume of the Christian Literature Association's *Nicene and Post-Nicene Fathers*, a translation of Jerome's *Lives of Illustrious Men*, founded on a new text, for which he collated the mss., including many which have never been used in earlier editions.

Macmillan & Co. have published an edition of *Trench on the Study of Words*, with questions by Professor T. W. Hunt, the intention and value of which may be seen from the following extract from Professor Hunt's preface:

"Archbishop Trench did a good work for students of English when he prepared this practical and popular discussion of words. Though it makes no claim to being a profound volume, it is sufficiently scholarly to subserve those educational

uses for which it was written, and has done as much as any other work of its kind to awaken and foster a genuine interest in the subject treated. First issued forty years ago, the fact that it has already passed to its twenty-second edition, and is taught so extensively in England and America, is a sufficient confirmation of its essential excellence as an elementary manual in word-study. Its main defect, however, is that of method. Though not illogical, it is somewhat unlogical, and needs a more definite and systematic arrangement. It was to meet such a need that the list of Questions herein printed was prepared for the use of the successive classes at Princeton. It is hoped that those teachers and students who are inclined to use them in the disciplinary work of the class-room may find them of practical value in the better understanding of the author."

The Rev. George T. Purves, D.D., pastor of the First Presbyterian Church of Pittsburgh, has been elected to the chair of New Testament Literature and Exegesis in the Seminary, made vacant by the death of Professor Hodge, and has signified his intention to accept this position. Dr. Purves is a native of Philadelphia, a graduate of the University of Pennsylvania and of Princeton Seminary. He was pastor for three years of the Presbyterian Church of Wayne, Pa.; for six years of the Boundary Avenue Church of Baltimore, Md., and for the past six years of the First Church of Pittsburgh. He delivered the Stone Lectures for 1888, which were published with the title, "*The Testimony of Justin Martyr to Early Christianity*." Four years ago he declined an election to the chair of Church History in the Seminary. It is expected that, the General Assembly concurring, Dr. Purves will take up the duties of his professorship at the opening of the next academic year.



MAIN CHEMICAL LABORATORY.—NEW BUILDING.

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. IV.

JUNE, 1892.

No. 3.

THE NEW CHEMICAL LABORATORY AT PRINCETON.

In a former number of the BULLETIN, Feb. 1892, a brief description of this building was given and in the present article it is proposed to give some details relating especially to the various laboratories in it and to the students' desks.

The main laboratory for students is on the top floor and is 71 feet 10 inches long and 50 feet 2 inches wide; the ceiling being 16 feet high. As already stated, it is admirably lighted by windows and a skylight, while efficient ventilation is secured by means of six large flues in the walls, by the windows themselves and by an opening four inches wide, running all around the central skylight and communicating directly with ventilators in the roof. The shortest distance from any window to a working desk is six feet, so that draughts are easily prevented from affecting the burners.

In this laboratory the ordinary routine of qualitative and quantitative chemical analysis is taught to students of all classes, since this mingling of students of all degrees of proficiency has been found to yield good results.

The students' desks are arranged in two sections in rows of six blocks each, the blocks in one section containing eight desks

each, and in the other section four desks each. At one end of the laboratory is a continuous row of ten desks. Light from windows on each side of the laboratory, as well as from the skylight, is equally distributed over all of the desks. The general arrangement of the desks is shown in the photograph of the interior of this main laboratory in our plate.

A sink one foot wide is put between each two desks; the sinks being of Trenton white ware, with glass traps. To each student is assigned his private desk, the top of which, excluding the sink, measures 5 feet in length and 2 feet in width, not including the bottle racks. The arrangement of the gascocks, suction cocks for filtering apparatus and water cocks is shown in the photograph. The desks on the right belong to the blocks containing eight desks; those on the left of the central passage way, to the blocks of four desks. On each side of the large water cocks on these latter desks, and constituting a part of the same cock, is a smaller cock, to which can be attached small rubber hose for connecting condensers, etc. The desks are of ash, and are covered with slate, the top of which is 3 feet 2 inches from the floor. After many tests the slate from the Monson Maine Slate Co., Boston, Mass., was selected as best resisting the action of acids. The reflected light makes it appear light-colored in the photograph, but it is a close-

grained, hard, black slate. The slabs are one inch thick, smooth-finished.

Each desk has two large drawers, and under these is a closet running the whole length of the desk and provided with one double and one single door. Although not very well shown, yet an inspection of the desks at the further end of the laboratory will illustrate the way in which the two drawers and the double doors of each desk are closed by a light brass hasp, which is fastened by a padlock and secures at the same time the drawers and the doors. The single door is fastened by an inside bolt which can be reached from the double doors, thus obviating the necessity of a large number of locks. The reagent bottles of each student are held in racks provided with sliding sashes and the bottles have enameled labels lettered in black.

Lead pipe, extra heavy, carries the waste water from the sinks to heavy cast iron waste pipes which run down the side walls of the building. All of the water, waste and steam pipes are accessible throughout their entire length in the building.

The suction for filtering is furnished by a direct acting steam pump in the adjacent boiler house. This pump was especially fitted for the purpose and has a steam cylinder 7 inches in diameter, air cylinder 6 inches in diameter, with a 6 inch stroke. With a steam pressure of only 10 pounds it has been found adequate to all the needs of the laboratory. The suction is regulated by a receiver of heavy boiler plate, 5 feet high and 2 feet in diameter, provided with a vacuum valve which automatically cuts off the steam when a given vacuum is reached. The pump was made by the A. S. Cameron Steam Pump Co., New York.

The connection between the suction cocks at the desks and the main suction pipe on the same floor is by half-inch lead pipe; the main suction pipe,

running to the basement, is of three-quarter inch lead pipe. In the basement are large Wolff's bottles containing solutions of sulphate of copper and of caustic potash, to purify the air, and from these bottles to the receiver (a distance of about 100 feet) the suction pipe is one-inch gas pipe. Although these dimensions seem small, yet under ordinary working conditions there is no perceptible difference between the vacuum at the receiver and at the students' desks. Three of the six hoods in this laboratory are shown in the photograph in sufficient detail to require but little further description. The ash frames have fixed glass sashes on the sides and the sloping top, while the front can be closed by the movable sash, with lead weights. The shelf of each hood is slate, and the cocks of the gas and water pipes are all outside of the hood and underneath the front part of the shelf, while the pipes pass up into the hood through holes in the back part of the slate. Water baths with constant level, sand baths, etc., are provided in these hoods.

The middle passage way shown in the photograph of this laboratory is five feet wide, and between the desks and each side wall is a passage way six feet wide. The distance between the adjacent blocks of desks is 5 feet and 6 inches, so that ample floor and air space is afforded for the number of students in the laboratory.

A drawer under each sink receives waste filter papers and similar solid trash. It should be mentioned that the ten desks in the row at the farther end of the laboratory are six inches shorter than the other desks.

The arrangement of the desks in the smaller laboratory for students on this floor is similar to that already described, but the desks are only 4 feet, 6 inches long, and are in blocks of six, with a semicircular sink at the end of each block. These

smaller desks, while amply large for work in qualitative analysis are hardly large enough for quantitative analysis.

Both of these laboratories are connected with the sulphuretted hydrogen room, which is about 11 feet square and is well ventilated by means of a large window, a shaft from the ceiling through the roof and a large flue in one wall. The sulphuretted hydrogen gas is generated in an adaptation of the apparatus made by Gerhardt for the Bonn laboratory. It consists of a glass cylinder 2 feet high and 5 inches in diameter, to contain the dilute sulphuric acid, with an inner cylinder about three inches shorter. The lower end of this cylinder is pinched together enough to keep the lumps of sulphide of iron with which it is charged from falling out, and the top of it is closed with a rubber stopper through which passes a glass tube, connecting by rubber hose with the wash bottle from which the gas is conveyed to the distributing cocks. The inner cylinder at Bonn is of glass, but at Princeton it is of lead tubing, about 2 inches in diameter. One such simple piece of apparatus furnishes all the gas needed for thirty students at as high a pressure as is ever required. The main service pipe is ordinary half-inch gas pipe, to which are attached nipples connected by short, stout rubber tubing with glass stop-cock tubes, and to these latter, by means of rubber tubing, the students connect the glass tubes which carry the gas into the solutions to be treated. The vessels containing these solutions are all placed within small hoods, closed by sliding glass doors and connected with one large flue.

The private laboratories for Professors and Assistants and the smaller laboratory for advanced students are provided with tables and hoods for the most part similar to those already described.

The assay laboratory in the basement has, for the use of students, several portable Battersea muffle furnaces and a stack of four crucible furnaces, so that each student may be able to have full control of the furnace in which he is making assays.

THE VISIT OF PRESIDENT EZRA STILES, OF YALE, TO PRINCETON IN

1754.

An interesting document has recently come to light, which has some items pertaining to the early history of the college. The Reverend Edward G. Porter, of Dorchester, Mass., discovered the diary of a journey, which Ezra Stiles, President of Yale College, made on horse-back from New Haven to Philadelphia and back in the autumn of 1754. A printed copy of it, which Mr. Porter lately laid before the Massachusetts Historical Society, has been sent by him to the College Library, and from it the following extracts are taken :

"[Sept.] 24. In morning took horses & with Mr. Ketteltas, & 3 other Dutch gent, took boat, & sailed 9 miles across to Staten Island, on which we road, till crossing a small ferry, we arrived at Elizabeth Town Point. Dined at Eliza. Town. Arrived at Newark about 3 aft. Waited on President Burr. Went to prayers, after which 2 young gent. of the college acted *Tamerlane* and *Bajazet*, &c. Lodged with Mr. Burr. 25. Commencement; waited on Mr. Prest. Burr & viewed the college library. Went to meeting, where we saw a most splendid assembly of gentlemen and ladies. In the forenoon heard the Exercises, after which S^r. Shippen* pronounced an ingenious oration. Afternoon, M^r. President began the exercises with a learned oration. Degrees conferred; among

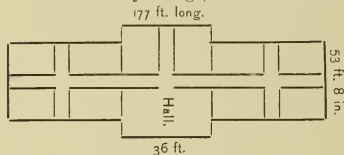
* William Shippen, Jr., M.D., Founder and Professor of the Medical School, College of Philadelphia, then a member of the graduating class, 1754.

others, degree of A. M. on Rev. Mr. Whitefield, who sat with Gov^r. Belcher in pew. Both forenoon & afternoon as the procession entered, & again when they went out of the meeting house, anthems were sung very melodiously by a chorus of men and women in the gallery. About half an hour after academic exercises, M^r. Whitefield mounted on a stage by the Court House, preached a sermon in open air to a large auditory from Luke 1, 15. * * * * *

Thence President Stiles continued his journey to Philadelphia, lodging in Princeton. On his return, the following entry is found in the Diary :

"Oct. 1. Breakfasted at Ferry. Viewed foundation and plan of college at Princetown, 177 f. long and 53 $\frac{3}{4}$ f. wide.

Plan N. Jersey college, Princeton :



The atria 10 ft. each.

Mr. Porter states "this plan is drawn three times in the diary, the painstaking writer evidently wishing to have it accurate," and further "that it was the largest stone edifice then in America" and "served as a model for University Hall at Providence, 1790." It will be remembered that the Rev. James Maning, then President of Rhode Island college, was a graduate of Nassau Hall, class of 1762.

We may note several interesting items.

1. It would appear that dramatic performances were early in vogue as it seems "2 young gent. of the college acted Tamerlane and Bajazet immediately after prayers on commencement eve." Query, was this some extract from Marlowe's *Tamburlaine*?

2. Princeton commencements were also early signalized by brilliant audiences. Dr. Stiles was impressed by "a most splendid assembly of gentlemen and ladies."

3. Vocal rather than instrumental music was served on such occasions. Instead of brass bands with their "sonorous metal breathing martial sounds," President Stiles mentions anthems "sung very melodiously by a chorus of men and women in the gallery."

When in 1896, the one hundred and fiftieth anniversary of the college is celebrated, might it not be well to revive this feature at least of one of our earliest commencements? JAMES O. MURRAY.

THE NEW REGULATIONS FOR THE DOCTOR'S AND MASTER'S DEGREES.

Toward the close of President McCosh's administration, the whole subject of University Degrees at Princeton was thoroughly reviewed, and regulations were adopted with the purpose of elevating the character of these degrees to the highest university standards. During the present academic year now closing, these regulations have been subjected to thorough re-examination, in order to incorporate in them such improvements as the experience of the last few years indicates to be desirable. Accordingly, the President and Faculty have devoted prolonged attention to the matter, and the result of their labors is embodied in a pamphlet containing the revised regulations which will be acted upon by the Board of Trustees this commencement.

The general scheme is substantially in accord with the old one, and differs from it only in throwing additional safeguards around the Master's and Doctor's degrees, and in giving greater definiteness and pre-

cision to the regulations generally. The principal changes proposed are as follows:

(1.) Hereafter it is proposed that the Master of Arts degree be conferred only upon the Bachelors of Arts who have done something to earn it, either by one year's exclusive graduate study in Princeton, or by two years' partial graduate study, or by submitting a satisfactory dissertation to the Faculty not earlier than the third year after graduation.

(2.) As the degree of Bachelor of Arts thus naturally leads to the degree of Master of Arts, this in turn is to lead to the final degree of Doctor of Philosophy. Accordingly, those who hold some other bachelor's degree than that in arts, will not be eligible for the degree of Doctor of Philosophy, save in exceptional cases. In the same way the degree of Bachelor of Science is made to lead to that of Master of Science and finally to Doctor of Science, and those who have some other bachelor's degree than that in science are consequently ineligible as candidates for the degree of Doctor of Science, save in exceptional cases. The degree of Doctor of Philosophy, then, is to stand for the sole degree which represents pure liberal culture, and the Doctor of Science to do the same for technical proficiency.

(3.) The experiment of allowing non-resident candidates for the Doctor's degree has been found to involve so much labor in the way of detailed oversight of non-resident candidates as to make it inexpedient to continue it. The safeguards, it is true, have been strictly adhered to, and the candidates have been of a high character, but it is felt that there is no safeguard equal to that of actual University residence.

(4.) The Preliminary Examinations have been somewhat stiffened. Those who apply to become candidates for either

doctor's degree will be required, without exception, to read ordinary French and German. Those who come up for the degree of Doctor of Philosophy in the department of Philosophy will need to add a reading knowledge of Latin to the subjects previously required. Those who apply in the department of Language and Literature will have to add a knowledge of general history.

(5.) It will also be noticed that there is greater definiteness in the statement of the Chief Subject which each candidate selects. It has been sought to avoid both the danger of extreme specialization to the injury of breadth of culture, and the opposed danger of superficiality, where the Chief Subject is too comprehensive. Thus, for example, Logic or Ethics, or History or Greek, or Physics or Biology, are specified as Chief Subjects, and by this it is meant that the candidate selecting any one of these will be held responsible for a general knowledge of the whole subject, and will be expected to show in addition a minute and complete acquaintance with some one part of it. This means that a candidate, say in Greek, will need to exhibit at his final examination a general acquaintance with Greek literature as a whole, as well as special proficiency in any period or author he may select. It is hoped by such a provision to promote the production of scholars who will be men of general intelligence, as well as of special excellence in particular subjects, and thus realize within limits the scholarly ideal of "knowing everything about something with something about everything."

(6.) Of the two subsidiary subjects, one must be strictly philosophical in the case of candidates for the degree of Doctor of Philosophy, with the exception noted in the text, and the other must be cognate to the Chief Subject, but not included

under it. In the philosophical subsidiary subject, the history of philosophy would naturally be the principal one chosen. However, Logic, Psychology, or Ethics will be admissible.

(7.) In every case hereafter the thesis, if accepted, must be published by the candidate, and moreover, the final examination must be conducted orally in the presence of the Faculty, and cannot be divided. However, there may be a supplementary written examination in the Chief Subject, at the discretion of the examiner.

(8.) Regulations for the degree of Doctor of Science harmonize in general with those of Doctor of Philosophy, but are specifically adapted to technical rather than liberal scientific scholarship.

The proposed regulations are given in full below :

MASTER OF ARTS (A. M.).

This degree may be conferred only upon a Bachelor of Arts of an approved college who shall have devoted one year exclusively to graduate study in this College under the care of the Faculty, passing examinations upon the studies pursued ; or shall have taken at least one University course each term for two years and passed satisfactory examinations upon his work ; or shall have submitted to the Faculty a satisfactory dissertation, ordinarily of not less than five thousand words, on some literary, philosophical or scientific subject, not earlier than the first of April in the third year after graduation. The fee for this degree is ten dollars, to be paid to the College Treasurer either before the candidate enters his last examinations, or else when his dissertation is handed in.

MASTER OF SCIENCE (M. S.).

This degree may be conferred upon any Bachelor of Science of an approved institution who shall have devoted one year exclusively to graduate study in this Col-

lege under the care of the Faculty in such of the following subjects as the Faculty shall prescribe, and who shall have shown satisfactory proficiency therein by dissertations and examinations : biology, mathematics, rational and applied mechanics, practical astronomy, applied chemistry, qualitative analysis, quantitative analysis, physics, mineralogy, graphics, modern languages.

Any Bachelor of Arts, who after examination may be found to be prepared to pursue a University course in science, may become a candidate for the degree of Master of Science on the same conditions as a Bachelor of Science. The fee for this degree is ten dollars, to be paid to the College Treasurer before the candidate enters his last examinations.

THE DEGREE OF DOCTOR OF PHILOSOPHY (PH. D.) IN PRINCETON COLLEGE.

Subject to the regulations hereinafter stated, the degree of Doctor of Philosophy may be conferred upon any Bachelor of Arts of Princeton College, or of any approved College whose Academic course is equivalent to that pursued in Princeton, provided he has spent at least two years in exclusive study for the degree. One of the two years must be spent in Princeton, and the other either at Princeton or some other approved university.

Applications for enrolment as candidates from those who hold some other Bachelor's degree than that in Arts, or for permission to count two or more years spent at another university, as the residence necessary for the degree, will be considered in exceptional cases.

REGULATIONS.

I. *The Preliminary Examination.*

Every applicant before enrollment as a candidate for the Doctor's degree must pass an examination in Princeton on the first Wednesday following the opening of the College in September.

All applicants are examined on their ability to read ordinary French and German with a fluency sufficient to ensure their use as instruments of advanced study.

They are also examined in the group of subjects connected with the general department of their proposed studies, as detailed below :

A. In the Department of Philosophy.

Ability to read Latin with a fluency sufficient to ensure its use as an instrument of advanced study.

General Psychology and Logic.

History of Philosophy, Ancient and Modern.

Outlines of General History.

B. In the Department of Language and Literature :

Outlines of General History.

General knowledge of the English Language and Literature.

Ability to read Greek and Latin with fluency sufficient to ensure their use as instruments of advanced study.

C. In one of the following six groups in the Department of Mathematics and Science :

1. In Mathematics.

Elementary Mathematics, including Trigonometry, Analytical Geometry, the elements of the Theory of Equations and the Differential and Integral Calculus.

2. In Astronomy.

Elementary Mathematics, including Trigonometry and Analytical Geometry. General Astronomy. General Physics.

3. In Physics.

Elements of Mathematics, including Trigonometry and Analytical Geometry. General Physics.

4. In Chemistry.

General Chemistry. General Physics.

5. In Geology and Physical Geography.

Elements of Geology, Zoology and Botany. General Chemistry.

6. In Biology.

Elements of Zoology and Botany. General Chemistry.

II. *Chief Subject of Study :*

Every candidate, after passing his preliminary examination, and before entering on his studies for the Doctor's degree, shall announce which one of the subjects in the appended lists he selects as his Chief Subject, and shall thereupon present to the Committee on University Degrees and Fellowships for their approval a statement of the said Chief Subject to which he intends devoting himself while a candidate, with such fulness of explanation as the Committee may require.

A. Department of Philosophy :

Logic.

Psychology.

Ethics.

Metaphysics.

History of Philosophy.

Philosophy of Religion.

History.

Political Economy.

Science of Politics.

Jurisprudence.

Archæology and Art.

B. Department of Language and Literature :

Sanskrit.

Greek.

Latin.

French.

German.

Italian.

English (including Anglo-Saxon).

C. Department of Mathematics and Science:

Mathematics.
Astronomy.
Physics.
Chemistry.
Geology and Physical Geography.
Biology.

III. *The Subsidiary Subjects:*

In addition to the Chief Subject, the candidate shall select two suitable Subsidiary Subjects and announce them to his examiners at some time in the first year of his course. One of these must be Logic, Psychology, Ethics, or the History of Philosophy, unless the candidate has chosen for his Chief Subject any one of those just named or else passes a satisfactory special examination on some one of them before entering upon his courses as a candidate. The Subsidiary Subjects should be cognate to the Chief Subject, but not included under it, and with this restriction any study enumerated in the lists of Chief Subjects may be taken, as well as the following which are not thus enumerated: Physiological Psychology, Pedagogics.

IV. *The Thesis:*

The candidate shall present a thesis on some special topic in the department which constitutes his Chief Subject at least four months before the degree can be granted. The thesis is not ordinarily to exceed twenty thousand words in length and shall not be accepted unless it contains evidence of thorough scholarship and ability to pursue original research, and if accepted it must be published by the candidate before the degree can be conferred. If the thesis is not accepted, the candidate will not be admitted to the final examination.

V. *The Final Examination:*

After the thesis has been accepted the candidate may proceed to his final exami-

nation at a time appointed by the committee on University Degrees and Fellowships. This examination in the Chief and Subsidiary subjects is to be conducted orally in presence of the Faculty, and cannot be divided. In the Chief Subject, however, there may be a written examination in addition to the oral, if the Examiner so requires. The candidate will be examined on his general knowledge of the Chief Subject, and will be expected to show in addition a minute and complete acquaintance with one principal part of it.

VI. *The Conferring of the Degree:*

Candidates who pass the final examination are ordinarily recommended to the Trustees for the Doctor's degree, and if the Trustees adopt the recommendation, the degree is publicly conferred by the President at the Annual Commencement in June. The degree of Doctor of Philosophy carries with it that of Master of Arts.

VII. *Fees.*

Those who apply for the degree shall pay to the College Treasurer a fee of forty dollars before entering the preliminary examination, twenty-five dollars each year thereafter, and fifty dollars when the thesis is handed in for examination.

THE DEGREE OF DOCTOR OF SCIENCE (D. SC.)
IN PRINCETON COLLEGE.

Subject to the regulations hereinafter stated, the Degree of Doctor of Science may be conferred upon any Bachelor of Science of Princeton College, or of any approved college or scientific school whose course is equivalent to that pursued in Princeton, provided he has spent at least two years in exclusive study for the degree. One of the two years must be spent in Princeton, and the other either at Princeton or some other approved university.

Applications for enrollment as candidates from those who hold some other

Bachelor's degree than that in Science, or for permission to count two or more years spent at another university as the residence necessary for the degree, will be considered in exceptional cases.

I. *The Preliminary Examination :*

Every applicant, before enrollment as a candidate for the Doctor's degree, must pass an examination in Princeton on the first Wednesday following the opening of the College in September.

All applicants are examined on their ability to read ordinary French and German with a fluency sufficient to ensure their use as instruments of advanced study and research.

They are also examined in the particular group of subjects connected with the subject of their proposed studies, as detailed below :

1. Mathematics.

Elementary Mathematics, including Trigonometry, Analytical Geometry, the elements of the Theory of Equations and of the Differential and Integral Calculus.

2. Astronomy.

Elementary Mathematics, including Trigonometry, Analytical Geometry and the elements of the Differential and Integral Calculus. General Astronomy. General Physics.

3. Physics.

Elementary Mathematics, including Trigonometry, Analytical Geometry and the elements of the Differential and Integral Calculus. General Physics. General Chemistry.

4. Chemistry.

General Chemistry. General Physics.

5. Mineralogy.

Elements (including Crystallo-

graphy. General Chemistry. General Physics.

6. Geology and Physical Geography.

Elements of Geology, Zoology and Botany. General Chemistry.

7. Biology.

Elements of Zoology and Botany. General Chemistry.

II. *Chief Subject of Study :*

After passing the Preliminary Examination every candidate shall announce which of the following departments he selects for his Chief Subject of Study :

1. Mathematics :

Including Higher Differential and Integral Calculus ;
Differential Equations ;
Geometry (Conics, Higher Plane Curves, Geometry of Three Dimensions) ;
Theory of Functions ;
Elliptic Functions ;
Analytical Mechanics.

NOTE.—In the final examination the candidate will also be tested with reference to his ability to make a computation with reasonable skill and accuracy. This will be necessary only where the candidate has had no satisfactory laboratory or observatory experience.

2. Astronomy :

Including either Practical Astronomy and Theory of Observations,
Or Computation of Orbits and Ephemerides.

3. Physics :

4. Chemistry :

NOTE.—A portion of the time will be required for the study of Qualitative and Quantitative Chemistry, unless the candidate is already sufficiently proficient in these branches.

5. Mineralogy.

6. Geology and Physical Geography:

Including either Practical and Engineering Geology, with Field Work,

Or Application of Palæontology to Determinations of Formations,

Or Physical Geography.

7. Biology:

Including the Morphology, Histology and Embryology of some one class of Animals or Plants;

Physiology;

Histological Methods and Practice;

Animal Embryology;

Modes of Reproduction of Plants.

III. *The Subsidiary Subjects:*

In addition to the Chief Subject the candidate shall select two suitable Subsidiary Subjects and announce them to his Examiners at some time in the first year of his course. The Subsidiary Subjects should be cognate to the Chief Subject, but not included under it, and with this restriction any study enumerated in the lists of Chief Subjects may be taken.

IV. *The Thesis:*

The candidate shall present a Thesis on some special topic in the department which constitutes his Chief Subject at least four months before the degree can be granted. The Thesis is not ordinarily to exceed twenty thousand words in length, and shall not be accepted unless it contains evidence of thorough scholarship and ability to pursue original research, and if accepted it must be published by the candidate before the degree can be conferred. If the Thesis is not accepted the candidate will not be admitted to the final examination.

V. *The Final Examination:*

After the Thesis has been accepted the candidate may proceed to his Final Examination at a time appointed by the Committee on University Degrees and Fellowships. This examination in the Chief and Subsidiary Subjects is to be conducted orally in the presence of the Faculty and cannot be divided. In the Chief Subject, however, there may be a written examination in addition to the oral, if the Examiner so requires. The candidate will be examined on his general knowledge of the Chief Subject, and will be expected to show in addition a minute and complete acquaintance with some one principal part of it.

VI. *The Conferring of the Degree:*

Candidates who pass the final examination are ordinarily recommended to the Trustees for the Doctor's degree, and if the Trustees adopt the recommendation, the degree is publicly conferred by the President at the Annual Commencement in June. The degree of Doctor of Science carries with it that of Master of Science.

VII. *Fees.*

Those who apply for the degree shall pay to the College Treasurer a fee of forty dollars before entering the Preliminary Examination, twenty-five dollars each year thereafter, and fifty dollars when the Thesis is handed in for examination.

EXHIBITION IN THE ART MUSEUM
OF MRS. GARRETT'S ENGRAVINGS.

A novel and interesting feature of this Commencement season is the exhibition of a selection of engravings and etchings belonging to Mrs. T. Harrison Garrett. They occupy the entire upper story of the Art Museum, arranged in 418 frames, which are filled with master-pieces of engravings of all schools and periods, selected in such a way as to give a remarkably

complete impression of the varied range of artistic qualities represented in etching, line-engraving and mezzotint, from the fifteenth to the present century. The rooms of the Museum were hastily finished in order to receive the display in time for Commencement. The light, coming through the glass roof, is remarkably good, and the arrangement and grouping have been made with great taste and judgment by Mr. Lee, of Baltimore.

The collection is characterized by the early state of many of the plates and the choiceness of the impressions.

One room is devoted especially to representations of the Holy Family, of which there is a most remarkable series. Among these especially to be noted are four plates of Raphael's Sistine Madonna, the most famous of which is a superb open-letter proof from F. Müller's plate. It is almost invidious to pick out any masters for especial mention. There are fine pieces by Martin Schöngauer, Albrecht Dürer and Luke of Leyden, among the early German masters, and of Marc Antonio among the Italians. Rembrandt's etchings are very fully represented. The French engravings include a large series of the great school of portraiture between the seventeenth and nineteenth centuries, from Nanteuil, Masson, Edelinck and Drevet to Desnoyers. Then there are the charming

Belisaire, the Belle Jardiniere and the Vierge au Poisson, by the inimitable Desnoyers. Among the German pieces we notice, for example, the first states of many of Wille's finest plates, and in some cases several states of the same plate; then, artist's proofs of Mandel's and Burger's plates of Raphael's Madonna della Seggiola. Among the works by English artists are some superb mezzotints, several of them by Earlom, and among line engravings, a superb example of Sharp's Doctors of the Church and Wollett's Battle at La Hogue. The Italian engravers of the early part of this century are represented by fine examples, like Raphael Morghen's Last Supper of Leonardo and Raphael's Transfiguration, Longhi's Spasmo di Raffaello, and other works by the founder of the Milanese school, as well as by his great scholar, Pietro Anderlone, and other Milanese artists of his school. Finally, a prominent and most attractive feature is a series by masters of the modern school of etching, there being examples by German, French and English masters.

It is very seldom that opportunity can be had, even in Europe, to see so many fine pieces on exhibition together, and Princeton is deeply indebted to Mrs. Garrett for her kindness and liberality.

ORIGINAL CONTRIBUTIONS.

THE CLOISTER OF ST. JOHN LATERAN IN ROME. PRELIMINARY NOTE.

By A. L. FROTHINGHAM, JR.

Perhaps the two most beautiful cloisters in the world are those of St. John Lateran and S. Paul-outside-the-walls in Rome. Both are known to be works of the first half of the XIII century, but no more precise date has been ascertained. Two

elements, however, served to assist in determining more closely the date of the cloister of St. John Lateran, namely, the style of both construction and decoration on the one hand, and the inscriptions giving the names of the artists on the other. The artists were Vassallettus and his father, the former well known as the greatest Roman artist of the XIII century, a sculptor, mosaicist and architect of the first

rank. He worked as late as 1263, and, perhaps, even 1276, and may be said to have been born shortly before or after 1200. At all events, he could scarcely have begun work on the cloister, as a young man, in connection with his father, much before 1220. The same answer is afforded by an examination of other cloisters in Rome and its neighborhood. Those of S. Sisto and S. Sabina, built towards 1220, are far simpler and of an earlier style, and yet the cloister of Sassovivo, near Foligno, dated from 1229, is stated to be in the Roman manner, *opus Romanum*, showing it to be an imitation of some structure in Rome, which can be none other than the cloister of St. John Lateran, for the cloister of St. Paul had not yet been built. For these reasons I had already hazarded the opinion (*Journal of Archaeology*, 1891) that this cloister could be assigned to the years between 1220 and 1230. This I can now confirm from a contemporary document, dated in 1227. It is the will of Cardinal Guala dei Bicchieri, a well-known diplomat of the XIII century, one of the legates to the Albigenses, and a patron of art, especially of architecture, who died in 1230. In his will, written in Rome in 1227, he leaves ten pounds of Provençal money for the work of constructing the cloister of St. John Lateran, and the wording is such as to show that the building was at that time being carried on. The Cardinal was often in Rome owing to the important share he took in papal politics, and his will is dated from the Church of S. Martino ai Monti. The fact that this clause had not been expunged before his death would show that in 1230 the work was still going on.

LEOPOLD KRONECKER.

By HENRY B. FINE.

Leopold Kronecker, one of the most illustrious of contemporary mathematicians,

the senior active professor of mathematics in the University of Berlin and editor-in-chief of the *Journal für reine und angewandte Mathematik* (Crelle), died at Berlin on the 29th of last December in his 68th year.

Kronecker did work of the first importance in no less than three great departments of mathematics: the theory of numbers, algebra, and elliptic functions. As an arithmetician his name is associated with the great names of Gauss, Dirichlet, and Eisenstein; as an algebraist with those of Abel and Galois.

Perhaps his most important contribution to mathematics was his "arithmetical theory" of the algebraic equation, which completes the famous theory of Galois. It carries the general theory of equations back to a theory of indeterminates which, before Galois, it was always assumed to be in the superficial and false sense, that the coefficients and therefore the roots of any equation may be treated as indeterminate.

But the fine quality of Kronecker's work is even more notable than its range or the importance of its results. He set the highest possible standard of mathematical rigor. Early in the *Grundzüge einer arithmetischen Theorie der algebraischen Grössen*, the great memoir in which he gave the first systematic presentation of his arithmetical theory, in defining an irreducible function, he says "Die Definition der Irreducibilität entbehrt so lange einer sicheren Grundlage als nicht eine Methode angegeben ist, mittels deren bei einer bestimmten vorgelegten Function entschieden werden kann, ob dieselbe der aufgestellten Definition gemäss irreducibel ist oder nicht," and proceeds therewith to supply the missing test. And this criterion, according to which no definition may be considered justified, no theorem established, until a method is supplied for determining in

every given concrete case whether the definition or theorem actually applies or not, he everywhere insisted upon, scrupulously meeting its requirements in his own work and sharply criticising all failures to meet them in the works of others. A definition which did not stand this test he denominated the invention of a mere fiction, an artificial abstraction for which there should be no place in mathematics.

This is the rigor of the ancient Greek geometry—in rejecting hypothetical constructions Euclid recognized a similar criterion—and though far enough from being always realized in the modern analysis, must characterize every mathematical theory in its final form. For, until it has been attained, either the ultimate elements of the theory have not been reached or the artificial concepts with which it has aided itself in its growth have not been set aside and the theory deduced directly from these elements.

Closely related to this fine conception of mathematical rigor are the other salient traits of Kronecker's work. It possesses that high artistic merit which consists in the perfect adaptation of means to ends. His methods are always pure, fit, direct, and the simplest which the requirements of absolute rigor will allow. Writing to Dirichlet in 1856 he says of a method which he has discovered for deducing the properties of solvable equations of prime degree, that it meets all the proper requirements of simplicity and rigor, "denn die Methode verlangt keinen irgend höheren Standpunkt mathematischen Fassungsvermögens als das Problem selbst, welches dadurch erledigt wird." And again for his principle of "association" he claims: "Sie gewährt den 'einfachsten' erforderlichen und hinreichenden Apparat, um die arithmetischen Eigenschaften der allgemeinsten algebraischen Grössen 'vollständig' und 'auf die einfachste Weise' darzulegen," adopting

the phrases which are quoted from the first proposition of Kirchhoff's Mechanics. This '*Einfachheit*,' to be sure, is of a kind which it oftentimes requires much reflection to appreciate. He was a foe not only of artificial concepts but of all artificial methods and of all artificial or purely formal tendencies in mathematics. He would have rid mathematics of the artificial numbers and of its "symbolic" methods, and the devising of new functions seemed to him a foolish waste of energy. "God created numbers and geometry," I once heard him say, "but man the functions."

It was his boast that he was the most practical of mathematicians. He said whimsically to me one day last summer: "It is a pity that you Americans do not know me better. You would surely appreciate me, I am so practical." And in a somewhat transcendental sense of the word, to be sure, he was profoundly practical. He sought to avoid all mere abstractions and to give his theories concrete form. Thus in the Galois theory he replaced the abstraction, a group of substitutions, by concrete functions which remain unchanged for the substitutions of the group. Neither definition, theorem, nor method had value in his eyes which could not be applied to concrete cases, which could not be made to yield concrete results. On this account he did not set great store by the services of the theory of substitutions to algebra. With all its beauty, he would urge, it is only formal, it does not show how to construct the group of a given equation.

Kronecker influenced the mathematical thinking of Germany as much through his lectures as through his published writings. He was a very stimulating and interesting lecturer. To an unusual degree he took his hearers into his confidence and allowed them the privilege of watching the actual evolution of his thoughts. His lectures

were not overprepared, but the details of even important demonstrations were left to take their chances in the lecture room. Occasionally there would be a disastrous slip in the reckoning or argument, or the outcome would be the discovery that the theorem sought to be established was false. But that only afforded opportunity to see the marvellous quickness with which he would run an error down and recover himself.

His lectures were always fresh. The principal courses were on determinants, theory of numbers, algebra, and definite integrals, and one of these in its turn he delivered each semester. But he never merely repeated himself. If a lecture did not differ from all its predecessors in content, it surely did in point of view or method. It was always the most recent product of his mathematical thinking. In his lecturing, moreover, he avoided the excessive conciseness which is the chief cause of the difficulty of his published writings.

Personally, Kronecker was most charming and amiable, a polished gentleman and man of the world. He was very generous with his time and thoughts, loving to talk to an appreciative listener of some favorite doctrine, or of the famous mathematicians with whom he had been associated.

He was a man of rare genius, a mathematician of the first rank in this century of great mathematicians.

From a paper published in the Bulletin of the New York Mathematical Society, May, 1892.

VANADIUM IN SUN-SPOTS.

By C. A. YOUNG.

In studying the spectrum of sun-spots a curious and interesting result has appeared. It is found that in the orange region of the spectrum the lines of Vanadium, which for the most part are ex-

tremely faint in the spectrum of the ordinary solar surface, are almost the most conspicuous of all those which come out as "characteristic" in the spot-spectrum. These lines were noticed long ago as very prominent in sun-spot spectra, but it was not then possible to identify them: the recent photographic observations of Professor Rowland upon the metallic spectra and their correspondence with the solar spectrum, make it now very easy to recognize their true origin. About thirty lines of vanadium exist in the portion of the spectrum which has been examined thus far, and every one of them, without exception, shows more or less widening and intensification, and several of them are even "reversed" through the centre by a fine, bright line. It remains to be seen whether a similar result will be obtained in other parts of the spectrum; and also whether this special conspicuousness of Vanadium is peculiar to a few spots only, or whether it is usual, as is probably the case.

In the course of his observations, Professor Rowland detected the presence of Silicon in the sun's atmosphere, and it is interesting to find that some of the hitherto unrecognized lines in the Chromosphere spectrum are due to this metal.

The existing catalogues of lines peculiar to the spectra of Sun-spots and the Chromosphere were made nearly twenty years ago, and need careful revision. They were made with instruments, which, although the best then available, were far inferior to those now at our disposal, and, of course, the wave-lengths then assigned to the lines are hardly more than approximations, and many of the "identifications" were erroneous, *i. e.*, there are a good many cases where it now appears that a line assigned to iron, for instance, really belongs not to iron, but to some other substance which has a faint line in its

spectrum so near to the iron line that the two appeared as one in the instrument used by the observer in making out his catalogue.

Naturally, therefore, one of the first pieces of work to be taken up here with

the new spectroscope is such a revision, and the results hitherto reported are to be considered as merely incidental to its prosecution.

PRINCETON, May 19, 1892.

SUMMARIES OF PAPERS PUBLISHED.

A RAPID METHOD FOR THE COMPLETE PRECIPITATION OF ARSENIC AS THE PENTASULPHIDE, AND FOR ITS SEPARATION FROM BISMUTH, ANTIMONY, LEAD AND SIMILAR METALS.

By FRED NEHER.

Some weeks ago in the course of an application of Dr. L. W. McCay's method for the determination of arsenic as the pentasulphide* to the analysis of a speise it was found necessary to separate small quantities of bismuth from the arsenic solution. The usual methods not proving satisfactory, experiments were made to determine whether arsenic could not be precipitated as pentasulphide in the presence of bismuth, without the simultaneous precipitation of the latter, by simply increasing the quantity of hydrochloric acid present during the action of the hydrogen sulphide. In the course of these experiments it was found that when a stream of hydrogen sulphide is led into a solution of arsenic acid in very strong hydrochloric acid the precipitation of the arsenic begins almost immediately, advances rapidly and approaches completion in a relatively short time.

Over forty carefully conducted tests served to show that by a strict observance of the following conditions the arsenic in an arsenic acid solution can be determined with the greatest facility and accuracy:

1. The solution should contain hydrochloric acid in the proportion of two parts concentrated hydrochloric acid (sp. gr. 1.20) to one part water. A greater excess, however, in nowise impedes precipitation, but seems the rather slightly to facilitate it. As a possible explanation of this action it is suggested that in the presence of such an enormous excess of hydrochloric acid a higher chloride or oxychloride of arsenic is formed, which is more readily acted upon by hydrogen sulphide than the corresponding oxide. The fact that when such a solution is heated arsenic trichloride is formed lends some probability to this view. Experiments show also that the arsenic before precipitating as pentasulphide passes through an intermediate sulpho-compound, possibly $\text{As Cl}_2\text{S}$, which yields essentially the same reactions as sulphydroxyarsenic acid.†

2. A continuous rapid stream of pure hydrogen sulphide should be passed into the solution for one hour and a half, though the precipitation is generally complete at the end of an hour. The filtrate should always smell strongly of hydrogen sulphide.

3. The solution must not be heated before or during precipitation; if heated, a part of the arsenic precipitates as trisulphide. Hence care must be taken to mix in the hydrochloric acid slowly, and not to allow the solution meanwhile to undergo any marked rise in temperature.

* Am. Chem. Jour., Vol. IX, No. 3.

† L. W. McCay: Zeit. f. Anal. Chem., Vol. XXVII, pp. 632-634; also, Am. Chem. Jour., Vol. X, No. 6.

Fourteen analyses of various quantities of several carefully standardized potassium arseniate solutions show an average variation of less than 0.0002 grm. in the quantity of pentasulphide obtained from the calculated amount, the greatest variation being 0.0003 grm. The precipitates were

weighed in Gooch crucibles after being washed, sometimes with alcohol and carbon bisulphide, generally only with *hot* alcohol, to remove the trace of free sulphur they usually contain, and dried in the air bath at 100° C. I select the following analyses as typical :

	TAKEN.	CALCULATED.	FOUND.
I.	40 C. C. sol. No. 1, 100 C. C. HCl. H ₂ S 40 minutes.	0.3510 grm. As ₂ S ₅ =0.1698 " As.	0.3509 grm. As ₂ S ₅ =0.1697 " As.
II.	20 C. C. sol. No. 1, 5 C. C. H ₂ O ; 50 C. C. HCl. H ₂ S 1 hour.	0.1755 grm. As ₂ S ₅ =0.0849 " As.	0.1752 grm. As ₂ S ₅ =0.0847 " As.
III.	15 grms. sol 2, treated as above.	0.1278 grm. As ₂ S ₅ =0.0618 " As.	0.1278 grm. As ₂ S ₅ =0.0618 " As.

The value of this method however lies not so much in its rapidity and accuracy as in the use which may be made of it to separate arsenic from several of the metals which are frequently met with in the course of analyses in solution with it. It has already been found possible to separate arsenic from antimony, bismuth, cadmium and lead by this method, as strong hydrochloric acid solutions of these metals remain clear when treated with hydrogen sulphide. The possibility of successfully applying the method, to the separation of arsenic from several of the other members of the fifth and sixth groups is also being investigated.

Abstract of an article written for *Fresenius' Zeitschrift für Anal. Chemie.*

THE ETHICS OF THE DIVINE COMEDY.

By E. W. EVANS, JR., Univ. Fellow.

In introducing his subject the writer declared that, in addition to the necessary lights which men of erudition or of critical acumen bring to the illumination of a great poem, the student of philosophy offers his own peculiar contribution. A

poem, like any other work of art, is an organism. Besides the flesh and blood of sensuous imagery, which a great poem must abundantly possess, there is implicit in it, as in all developed structures, a complicated skeleton of speculative thought, which it is the privilege of the philosophic critic of literature to explicate. A poem, great enough to be called a world-poem, is one that has penetrated the intellectual and emotional life of many typical individuals, and has portrayed these several sorts of persons in their corporate, moral capacities, as related to family, to society, to the state and to the church. These central questions of theory and morals, which are implicate in the framework of a great poem, the philosophic student of art may render explicit, but in so doing, he does not at all eviscerate the poem as a work of genius ; he does not seek to substitute his tentative interpretation of the inner meaning of the poem in place of the "mystic unfathomable song" itself. He merely does for the art-product what the scientist does for physical nature, and the metaphysician does for reality—he sends out the inter-

pretative rays of reason, so that they may rest upon the work of art, and give added light and more profitable pleasure to those who examine the picture or read the poem. The theme and treatment of the Homeric epics were then contrasted with those of the "Divine Comedy;" and the conclusion was reached, that, in Dante's poem, virtue and vice and their fitting consequences were impressively manifested, not as they appear in this world of slow-moving natural law, but as they really are in a world of spirits where facts are seen *sub specie aeternitatis*, under the white light of eternity. Dante's endeavor in the "Divine Comedy" was to represent artistically, and therefore most adequately, the possible attitudes of the human will toward the divine will, and the effects flowing therefrom. The whole structure of the poem, therefore, rests upon the freedom of the will, the question of human freedom being in its turn dependent upon the conception which is entertained of the highest principle of the universe—God. Dante's Christian conception of God was then contrasted with that found in the Oriental religions. The conclusion arrived at was that, as God possessed a completely fashioned will, man, the finite image of his Creator, might serenely intrench himself behind his own limited bulwark of freedom, and act out in time and space that which God knows from all eternity. Personality, with its accompanying responsibility to God, whose perfect nature furnishes the norm of the true and false, the good and evil, is the cornerstone upon which rest the "Inferno," the "Purgatorio" and the "Paradiso." The natural and necessary consequences of sin were then examined in the light of Dante's psychological and figurative treatment of them; and his positive conception of sin was contrasted with a facile ethical optimism current in much of the

metaphysical speculation and artistic portrayals of the day. Dante's idea of the relation of the will to the innate endowments of man, his primary appetences and affections, was then discussed. And the emerging problem of love—Dante's word to include the whole range of passion, desire, emotion, affection—as uncontrolled by the will, was developed in its bearing upon the seven cardinal sins. These were then severally graded in a scale of ethical value according as they tend more or less to destroy the social cosmos—which latter is held together by the ethical relationships subsisting between the individual and himself regarded as object, between the individual and God, and between the individual and other persons, or aggregates of persons, as the family, the economic corporation, the church, and the state. It was then explained why these several sins were atoned for in their general and immediate forms in the "Purgatorio," while in the "Inferno" the majority of them were punished in their special effects. This consideration naturally led to the larger question of the fundamental ethical distinction between the sinners in the "Inferno" and those in the "Purgatorio." And it was found that the delinquents whose condition is symbolized under the name of Hell have so smothered their wills in the fumes of inordinate and perverted desire that they have become fatalists; while the souls in Purgatory, not having been dulled by atrophy of the will and by reiterated transgression, comprehend the reaction of sin as the result of freedom, not of fate. The optimistic formula of innocence, sin, developed self-consciousness, is therefore seen to apply only to the latter class of sinners, not at all to the former. It is only as one withdraws into the silent halls of consciousness and there sees written upon his soul by the hand of God and of natural law the

consequences of his own sinful act, that there is the possibility of purification. When our sins are viewed by the clear light of freedom, and not by the obscurity of fate; then, and only then, will we willingly, and like the souls in the "Purgatorio," even eagerly, endure the suffering and shame of sin that thus we may rise purified, and may at last reach that "Paradiso" where will and desire are in glad acquiescence. Then we, as pure spiritual personalities, will love and respect others as pure spiritual personalities, and the vision of God will be assured.

* Abstract of a paper read before the Philosophical Club May 17, 1892.

HISTORIC DEVELOPMENT OF GOTHIC IN ITALY.

By A. L. FROTHINGHAM, Jr.

In passing from the north of Europe to Italy, Gothic architecture took a shape so different in character as to have caused contradictory suppositions as to the source from which it was introduced into Italy, and contradictory judgments as to the artistic character and value of Italian Gothic. After laying down the constructive principles of Gothic as a skeleton of ribs sustaining vaults whose equilibrium is maintained by thrust and counter-thrust, the paper of which this is a summary sketched the history of vaulting in France before and during the early Gothic period, and then gave in greater detail the attitude toward vaulting of the various Italian schools of architecture during the two centuries preceding the introduction of Gothic. The Italians were pre-eminently painters and lovers of color; for form they cared less; for the discovery and development of constructional principles they cared almost nothing, except in the north, where the Germanic tribes had brought in an infusion of Northern blood. The wooden roofs were, therefore, pre-

served throughout Italy, the exceptions being in the case of Byzantine influence as at Venice, in Calabria and other parts of the South; Mohammedan influence as in Sicily, French-Norman influence as in the South, and French-Burgundian influence in the monastic constructions of the Cistercians. The only case of independent development of vaulting was, as indicated above, in Lombardy. There was, therefore, no architectural movement in Italy to which the Gothic could attach itself: it had to be imported and started there on an independent basis. Many critics have thought that it was imported from Germany. The first point of importance in this paper was a series of proofs that the importation was from France, and was not effected at one moment, but was a continuous operation extending over a period of forty or fifty years, beginning in about 1170 or 1175 and continuing through the first quarter of the thirteenth century. The works erected during this period by the French architects and their pupils were purely French in style, or but slightly tinged with Italian peculiarities, and are consequently more pure than the corresponding constructions in Germany or England. The agency for the importation was the Cistercian order of monks. Each of these large monasteries not only required and gave occupation to a large number of architects on account of the number and size of their structures, but had training schools for architects whom they sent out, either to erect affiliated monasteries when they were members of the order, or to practise the style as lay architects. There were about ninety Cistercian monasteries in Italy. Burgundy was the source of the style, and the model structure there may be said to be Pontigny, on which Fossanova, in Italy, was modeled. The same men who built Fossanova appear to have gone from there to

build Casamari and Arabona, shortly after 1200, and then, in about 1218, to S. Galgano, near Siena. At the same time, about 1207, S. Martino al Cimino, near Viterbo, was being built, showing rather the influence of the Ile-de-France than Normandy. In the towns and cities near these and other large Cistercian monasteries, the same early Gothic style was used in the cathedrals, parish churches, monastic structures, city halls, castles, private houses. The church of S. Andrea, at Vercelli (1219-24), cited hitherto as the earliest example of Gothic in Italy, is proved to be built on a Cistercian model, and in particular to be copied from such a structure as the Cistercian church of Vaux-de-Cernay.

A second group of buildings, best exemplified by some monuments at Viterbo, show the transition from the Cistercian to the Dominican and Franciscan forms of the Gothic. These two mendicant orders in adopting Gothic at once as their style, showed their usual ability and foresight, and by their action Umbria became the starting-point for a form of Gothic that is specifically Italian.

There are five specifically Italian schools of Gothic which are strongly marked: (1) the Lombard; (2) the Venetian; (3) the Florentine and Tuscan; (4) the Umbrian; and (5) the Angevin, in the South. Most of these borrowed certain traits from the Cistercians, such as, in the ground-plan, the square apse, and in the structure the ribbed cross-vault, though in the use of the latter they retrograded rather than progressed. The principal variations from the Cistercian models were as follows: Owing to the large city congregations gathered in Dominican and Franciscan churches, wider naves and aisles, loftier aisle-vaults and piers more widely spaced, were needed to help eyesight and hearing.

Hence the approach in the interiors to the German type of hall-churches, with side-aisles nearly as lofty as the nave, with lofty, heavy piers separating the nave from the aisles. There is no forest of piers, no rhythm of ascending lines, no development of carved mouldings, no great windows filled with painted glass; but in their place a wide expanse of wall covered with frescoes.

Such were the general characteristics: besides these, each school developed special features. The thirteenth century was the period for monastic churches and town halls: the fourteenth century the period of cathedrals. During the first the architects were nearly all monks; during the second they were largely laymen belonging to the art guilds organized in almost every Italian city.

Italian Gothic architects may be said to have achieved the greatest success in their civil and private architecture, whose monuments surpass those of any other country in Europe: the city halls of Florence, Siena, Perugia, Cremona, for example; the palaces of Venice and Verona are examples of their best work.

Finally, a distinction was drawn between *system* and *style*. Some writers have contended that the Italian architecture of this period cannot be called Gothic at all, because it does not carry out logically and fully the principles of Gothic established in France. Granting this, it is only proved that Italy did not adopt the Gothic *system*. But the purely artistic form, the higher art as contrasted to the more material science; what we may call the style of Gothic architecture, is quite another matter. We most emphatically assert that Italy developed in varied form its side of Gothic style, and that it has a perfect right to a place in the European art concert of this period and style.

NOTE ON SOPHOCLES OED. TYR. II.
44-45.

By N. E. CROSBY.

ὡς τοῖσιν ἐμπείρουσι καὶ τὰς συμφορὰς
ζώσας ὁρῶ μάλιστα τῶν βουλευμάτων.

This passage is most exhaustively treated by Prof. Jebb in his recent edition of Sophocles' plays. He devotes more than *cleren* pages of his appendix towards elucidating these lines, and successfully refutes, in my opinion, Kennedy's translation of the words *ξυμφορὰς τῶν βουλευμάτων* by 'comparisons of counsels.' His chief arguments are (1) that the word *ξυμφορὰ* nowhere else bears the meaning of 'comparison' in all classical literature; (2) that even if such usage could be admitted, the order of words is decidedly obscure, the genitive *τῶν βουλευμάτων* being so far removed from the noun *ξυμφορὰς*, the extraordinary meaning of which would scarcely be imagined by the listener, even if the qualifying genitive were close at hand. To my mind, this self-same argument might be used against Prof. Jebb's version of the passage, which follows that of an old scholiast and which translates the phrase by 'the *issues* of their counsels.' I do not deny that the phrase *τὰς ξυμφορὰς τῶν βουλευμάτων* might mean 'the occurrences that have to do with their

counsels' as Prof. Jebb argues, but I contend that *ξυμφορὰ*, when found alone without modifying genitive close at hand, is 'a turn of events,' either 'hap' or 'mis-hap,' usually the latter. Now the listener would most certainly regard the word here as signifying 'mishaps' or 'troubles,' there being no modifier near by and the intensive *καί* requiring some stronger idea than simple 'hap' or 'occurrence' would convey. A careful reading of the lines will I think impress this fact on the reader's mind. How then do we explain the genitive *τῶν βουλευμάτων*? It is the *casual* genitive, the same construction precisely as in line 48, *τῇν πάρος προθυμίᾳς* (cf. ll. 697 and 1478). We may translate then: 'Since I see generally that in the hands of wise and experienced men *even* troubles (calamities) turn out prosperously, by reason of their counsels.' There can be no question as to the suitability of this rendering to the foregoing lines, or as to the evident force of *καί* in it, whereas I must confess that to me Jebb's reading, though so stoutly defended by him on the ground of its harmony with the preceding lines, seems decidedly lacking in such accord, and falls rather flat, requiring a somewhat far-fetched explanation both in regard to its proper position in the argument, and the force of the *καί*.

REVIEWS OF BOOKS.

ETHICAL TEACHINGS IN OLD ENGLISH LITERATURE, by Theodore W. Hunt, Ph.D., Litt.D., Professor of English in the College of New Jersey. 12mo. pp. 384. New York: Funk & Wagnalls Co. 1892.

This book is in a line with those previously published by Professor Hunt, and well known to students of English literature. Its special object, as stated in the preface, "is an ethical one rather than

linguistic or critical. Technical and minute discussion is purposely made subordinate to as brief and popular a presentation of the theme as the subject-matter will allow."

There is first an introductory essay on "The Ethical Element in our Earlier Literature," whose aim is to show the presence of the moral element in this literature, and to deduce from this fact some

lessons as to the ethical character of later literature. The author begins with the Celtic age as one of moral preparation, then passes to the age of development, from Caedmon on to the end of the Saxon period. The outstanding characters of this period are Caedmon, Bede and Alcuin. Later came the modification of life and literature by the Danish invasion and the Norman conquest. With the exception of the age of Charles II there is found in all pre-Elizabethan literature a predominating ethical element. The moral indebtedness of all later English literature to this element is emphasized, and the question is raised, whether this prevailing ethical tone characterizes the English literature of the present or not. Professor Hunt finds, in answer to this question, a moral declension, and a need of a profound moral awakening.

The body of his book is divided into two parts: I. The writers from Caedmon to Chaucer, not including the latter; II. The writers from Chaucer to Ascham.

Part first consists of twelve chapters, as follows: Chapter I. Caedmon's Scriptural Paraphrase. "The object of this chapter is to show that, from the seventh century of English song down to the present, the spirit of Caedmon and of Milton has been abroad to keep in abeyance all lower tendencies, and hold the rapidly unfolding volume of English verse loyally true to its earliest ethical standard." Chapter II. The Bible and the Homily in Old English. Special attention is called to the Homilies as a marked feature of English literature down to the time of Wiclif and Tyndale. Then follow brief treatise on "The Ethical Teaching of Beowulf;" "Venerable Bede, the Old English Church Historian;" "King Alfred's Version of Boethius;" "Cynewulf's Trilogy of Christian Song," which is characterized as genuinely poetic and genuinely Christian;

"The Church and the School in Old England," in which it is shown that religion was the father of education, the school the child of the church; "Layamon," who stands on the dividing line, at 1200 A. D., between the old and the new in English History, and whose work was strictly transitional;" "Orm, an Old English Poet Homilist;" "Richard de Bury, an Old English Book-Lover;" "Richard Rolle, the Hampole Hermit," and "Old English Saws and Proverbs."

Part second is also composed of twelve chapters treating of "The Ethical Spirit of Chaucer's Writings;" "The Course of the World, a Bible Homily;" "The Church and the Stage in Old England;" "Sir John Mandeville, the Palestinian Traveller;" "John Wiclif, an Old English Reformer and Translator;" "An Old English Religious Satirist," William Langlande, whose *Piers Plowman* is called a kind of Protestant evangel nearly two centuries before the Protestant Reformation; "John Gower," whose "*Vox Clamantis*" is the deep and solemn protest of an 'old patriot and religious reformer against the open excesses of his time;" "Old Religious Satire," from 1400 to 1550; "William Caxton;" "Hugh Latimer, the Homilist," whose only literary work was his sermons; "William Tyndale and his Biblical Work," and "Roger Ascham, an English, Old and New," the unique embodiment of old and modern England.

A concluding chapter is added on "The English Bible and the English Language." This gives a historical sketch of the various versions of the Bible, partial and complete, from Aldhelm in the eighth century to the recent revision of King James's version. There is an appendix, containing an Old English version of the Lord's Prayer and the Apostles' Creed, and a reference list of books and authors. The book is dedicated to Professor Francis A. March, of Lafayette College.

J. H. DULLES.

WALTER SAVAGE LANDOR. A Critical Study, by Edward Waterman Evans, Jr., University Fellow, Princeton. New York: G. P. Putnam's Sons, 1892.

This little book aims to present Landor to the reader, not from the standpoint of biography, as does the elaborate work of John Forster, nor yet in the manner of Mr. Sidney Colvin, in his account of the English Men of Letters Series, but "has been written in the effort," as Mr. Evans says in his preface, "to determine Landor's place and function in literature." It is accordingly an essay in literary criticism.

Mr. Evans considers Landor under four aspects: first, as a man of letters; second, as a poet; next, as a master of prose; lastly and briefly, in his relation to literary ideals and methods, with the view of determining his place and quality. At the end Mr. Evans adds, in form of an appendix, a poem of some two hundred verses, entitled "The Shadow in Stone," idyllic in its cast and prompted by Landor's spirit of dealing with æsthetic ideas from the antique. "Landor was an idealist, whose intellectual life lay in the past," is our author's saying in one place (p. 21), and the judgment is a sound one. Not that he confined his searchings and studies to Greek literary products, but that he was truly on the æsthetic side—a late-born

Greek, and not wholly in place in the generations of modern men. Hence he had so much tranquillity of spirit within, so much genuine delight in the company of his ideals, and so much noisy unrest and outward annoyance because of what he found about him. His sense of idolatry went so far that toward the end of his life he distrusted the thought of his writings having any future fame. "I claim no place in the world of letters," he wrote to Lord Brougham, "I am and will be alone as long as I live, and after." Posterity has judged him better. Though not a writer for the crowd, and of necessity restricted by the subtle and really noble quality of his style, to the few; though deficient "in tact and sympathy for the reader," and almost destitute of spiritual insight, his style is, as Mr. Evans observes, truly "flawless," and he has moreover enriched literature with a choice furnishing of idyllic and dramatic pictures on poetic side, and prose pieces of high critical and æsthetic value, especially in his *Pericles and Aspasia*. That these will always attract spirits kindred to his own, and that his own character has some of the traits that are sure to appear again and again in cultivated men, and above all in men of genius, we sincerely believe.

ANDREW F. WEST.

NOTES.

EXAMINATIONS FOR DOCTOR'S DEGREES.

The following applicants having completed their courses of study and fulfilled all the requirements, were recommended to the Board of Trustees for Doctor's Degrees:

JOHN IRENAEUS MCCAIN, A. B., Professor of Greek and English in Erskine College, South Carolina, for the degree of Ph. D. in Literature,

Subject of Thesis: *Middle English Philology*.

Chief Subject: English. Examined on Period of the Elizabethan Drama, and Textual and Etymological Work in Early English.

Subsidiaries: German Literature of the Eighteenth Century and the Philosophy of Plato.

GEORGE MCLEAN HARPER, A. B., Professor of French in Princeton College, for the degree of Ph. D. in Literature,

Subject of Thesis: *The Legend of the Holy Grail.*

Chief Subject: French. Examined on French Literature of the Seventeenth Century.

Subsidiaries: Italian as Illustrated by Dante, and Thomas Aquinas and his Times.

CHARLES GRAHAM DUNLAP, A. B., Professor of English Language and Literature in Kansas University, for the degree of Litt. D.

Subject of Thesis: *Introduction to a Commentary on The Ploughman's Tale.*

Chief Subject: English. Examined on English Literature.

Subsidiaries: Anglo Saxon and Gothic, and English Constitutional Law.

JAMES HARRINGTON BOYD, A. B., Professor of Mathematics in Macalaster College, Minn., for the degree of Sc. D. in Science.

Subjects of Thesis: "*A Geometrical Study of Certain Cases of the Hyper-Geometric Differential Equation.*"

Chief Subject: Mathematics. Subjects of the Examination: Geometry, Theory of Functions, and Differential Equations.

Subsidiaries: Mathematical Astronomy, and General Physics, with Mechanics and Optics.

The examinations were conducted orally in presence of the Faculty.

HONOR LIST OF THE CLASS OF 1892— ACADEMIC DEPARTMENT.

HONORS FOR GENERAL EXCELLENCE.

Magna cum laude.

Albert Frost Earnshaw,
Le Roy Gresham,
James Peter King,
Bowdre Phinizy,
William Kelly Prentice,
Irving Whitall Street,
John Glover Wilson,
Clinton Tyler Wood.

Cum laude.

Frederick Randolph Bailey,
Robinson Potter Dunn Bennett,

George Whitefield Betts,
William Little Bradley,
James Chester Brewster,
Elmer Baldwin Cole,
Leon Martin Conwell,
Elmer Jacob Cook,
Harry Franklin Covington,
Herman Stearns Davis,
John Tatham Dunn,
Harry Slawson Dunning,
John William Easton,
Marcus Stults Farr,
Max Farrand,
Andrew Caldwell Gray,
Henry Clay Havens,
Caspar Wistar Hodge, Jr.,
Preston Stewart Kreckler,
Hugh Archie Lynn,
Lorenzo Grenville Lyon,
John Maclean Magie,
William Leroy Mudge,
Charles Hitchcock Newton,
John Walter Parker,
William Belfrage Parsons,
Joseph Mitchell Shellabarger,
John William Stork,
Williamson Updike Vreeland,
James Westervelt,
Benjamin Vroom White,
Percy Wilson,
Walter Livingston Wright, Jr.

HONORS FOR EXCELLENCE IN SPECIAL DEPARTMENTS.

Classics,

Elmer Baldwin Cole,
Henry Clay Havens,
William Kelly Prentice,
Clinton Tyler Wood.

Mathematics and Math. Science,
Walter Livingston Wright, Jr.

Modern Languages,
Williamson Updike Vreeland.

Archæology and Art,
Benjamin Vroom White.

Mental Philosophy,
Caspar Wistar Hodge, Jr.
James Peter King,
Irving Whitall Street,
Clinton Tyler Wood.

History and Political Science,
Bowdre Phinizy,
John Glover Wilson,
Percy Wilson.

Natural Science,
 Marcus Stults Farr.

APPOINTMENTS FOR COMMENCEMENT.
 JOHN GLOVER WILSON, *Latin Salutatory*.
 JAMES PETER KING, *English Salutatory*.
 WILLIAM KELLY PRENTICE, *Valedictory*.

HONORARY ORATIONS.
 LE ROY GRESHAM,
 BOWDRE PHINIZY,
 IRVING WHITALL STREET,
 CLINTON TYLER WOOD.

CHANGES IN THE SCHOOL OF SCIENCE.

Since the Department of Chemistry has been removed from the School of Science building to its new quarters in the Chemical Laboratory, there has been a reassignment of rooms to the other departments which occupy the building. The Engineering Department has abandoned the rooms which it occupied as laboratories and recitation rooms, on the south side of the building, and has removed to the rooms left vacant by the Chemical Department. The partitions between Prof. Cornwall's private laboratories and the old drawing room have been removed, and the capacity of the drawing room thus doubled. The Professors in the Engineering Department occupy the rooms which were formerly Professor McCay's laboratory and the store room, and the Engineering laboratory is now in the old Quantitative laboratory. The Mineralogical room has been made into two recitation rooms, and the old Chemical lecture room is now used for Engineering. The Mathematical Department has taken possession of the old Engineering lecture room and of the small recitation room adjoining it. Professor Rockwood's private room is now on the second floor in connection with these new recitation rooms. The lecture room has been fitted with blackboards. The old Engineering laboratory, on the south side, has been turned over to the Physical De-

partment. It has been connected with the Physical laboratory above it by a spiral staircase, and the two rooms are now used as the working laboratories for the class in practical physics. The former apparatus room of the Engineering Department is now the room of the Assistant in Physics. The new Physical laboratory is fitted with tables attached to the walls, and free from the floor, so as to avoid, as far as possible, all disturbances from vibration.

This year the additions to the various classes have been as follows: To the Senior Academic Class, 7; Junior Academic, 8; Sophomore Academic, 18. The Freshman Academic Class numbers 168. To the Junior Scientific Class, 1; Sophomore Scientific 7; the Freshman Scientific Class numbers 91. The First Year Class of the School of Electrical Engineering numbers 11. The total number of entering students enrolled for 1891-'92 is accordingly 311. The total enrollment of the College has increased 96.4 per cent. in the last six years.

THE LIBRARY.

The regular issue of books from the library during the past year reached the twenty thousand point on Monday, June 6. This is an increase of something more than twenty per cent. over the same period last year. The total issue for the year, including one-day books, will be not far from 26,000. The total increase in the issue of regular books for the past year will be about 22 per cent. over last year, and 80 per cent. over the previous year. The use of the alcoves shows that about fifteen thousand visits to the shelves have been made.

"The Development of the Brachiopoda" by Charles Emerson Beecher, Ph.D., appears in *Neues Jahrbuch für Mineralogie, Geologie und Palaeontologie*.



DAVID BROWN HALL.

PRINCETON COLLEGE BULLETIN.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

VOL. IV.

NOVEMBER, 1892.

No. 4.

DAVID BROWN HALL.

On the 21st of September last, the College entered into the possession of a handsome building to be known by the above name in commemoration of the husband of Mrs. David Brown. This is the second substantial evidence of this character, which Mrs. Brown has given of her kindly feeling towards the College, her endorsement of its aims and her appreciation of its most pressing needs.

The building stands on the southern side of the newly completed south quadrangle, and is an imposing structure, in good keeping with the other handsome buildings which surround it. The quadrangle is indeed noteworthy for the differing character and fine execution of the buildings which enclose it; the two marble Halls, the Art School, Albert B. Dod Hall and David Brown Hall are all worthy companions in this group of buildings.

David Brown Hall is modeled exteriorly after one of the palaces of ancient Florence. Its two lower stories are built of Quincy granite, and the two upper of Pompeian brick. The building is entered through a handsome archway leading to the central court-yard. There are four entries leading to the hallways from this court, which lead to the thirty-two double and twenty-two single rooms in the building. The hallways are located so that the

windows lighting them open upon the court; they are large and well lighted, of open construction, the rafters being cased in oak, while the stairs and balustrades are of the same material.

The rooms are located on the outside of the building, and are all equally desirable, the favorites being upon the southern side commanding the fine view of the rolling lowlands in that direction. They are all well lighted, and those upon the north side are the only ones which will not have the direct sunlight for a part of the day. They are heated by open grates, and each room has its own coal-locker in the hallway. The internal finish of the rooms is of yellow pine and poplar.

The building may be said to be an experiment in the way of a college dormitory on account of many novel features in its construction. The day is past when it was considered necessary that the student should live in a dungeon, or with surroundings which reminded him of a poor-house, and it is hoped that this and all coming generations of students will appreciate these comforts derived from the bounty of our benefactors.

The building was designed by Mr. J. Lyman Faxon of Boston, and has cost over \$100,000.

After the opening exercises of the College the building was opened to the public. President Patton in a short address thanked

Mrs. Brown for her gift, and then dedicated the building to the memory of her husband in prayer. It was a pleasure to have Mrs. Brown in attendance upon this occasion, and have her throw open the doors of the building with her own hand.

BUILDING NOTES.

The building operations which are in progress on the campus were rapidly pushed during the summer. As full descriptions of the new buildings will be given from time to time in the BULLETIN, it is only necessary now to note the progress which has been made on them. The Halls of the Literary Societies were finished at Commencement, so far as their exteriors were concerned, but considerable additional work has been done on them. Their appearance has been greatly improved by the removal of the piles of earth and debris which surrounded them. The David Brown Hall is finished, and was formally opened on the first day of the term. The new Commencement Hall, given by Mrs. Charles B. Alexander, is so far advanced that its general effect can be seen. Only a few stones remain to be laid, and the roof is being put in place. The Isabella McCosh Infirmary lacks still the interior finish. The walls of the Brokaw Memorial Field House are being constructed, and the grading of the field is proceeding on a most extensive plan. The Princeton Inn, a building which, though not college property, will yet be of great service to the institution, is also making rapid progress.

Extensive grading was done during July and August in that part of the campus lying south of the halls. The ground has been levelled and sown with grass-seed, and walks have been laid. This part of the campus, bounded by Clio

and Whig Halls, by Albert B. Dod Hall, by David Brown Hall, and by the Art Museum, will be known as the South Quadrangle.

Some changes have been made in the interior arrangements of the School of Science, that were made possible by the removal of the Department of Chemistry to the Chemical Laboratory. The lecture-room and the two adjoining rooms on the first floor, which were used for chemistry, have been assigned to physics, and the corresponding rooms on the second floor have been given to biology and astronomy. The Department of Graphics now uses the lecture-room which has hitherto been used for astronomy, and also takes the old biological laboratory as a drawing-room.

CANDIDATES FOR THE DOCTOR'S DEGREE.

The Preliminary Examination for Higher Degrees was held September 28th in the Faculty Room. The following new candidates were enrolled:

Mr. Alfred Pearce Dennis, A.B., Princeton 1891, for the degree of Ph.D., with History as the chief subject.

Mr. Francis M. Frazer, B.S., Princeton 1888 M.D. 1891, candidate under the old plan for the degree of Ph.D. in Science, with Physiological Psychology as the chief subject.

Rev. John Grier Hibben, A.B., Princeton 1882, for the degree of Ph.D., with Ethics as the chief subject.

Mr. Caspar Wistar Hodge, A.B., Princeton 1892, for the degree of Ph.D., with Metaphysics as the chief subject.

The total number of candidates at the present time (November 1st) is twenty, distributed according to their chief subjects, as follows:

In Mental Philosophy,	6
In History and Political Philosophy, . .	3
In Classics,	2
In Modern Languages,	3
In Mathematics,	3
In Chemistry,	1
In Biology,	2

The newly revised regulations for the Doctor's degree, which passed the Faculty last December, were approved by the Board of Trustees through the Committee on the Curriculum, in June, 1892, and are now in operation. Copies may be obtained from the Registrar of the College.

ORIGINAL CONTRIBUTIONS.

CONFIRMATION OF BARNARD'S DISCOVERY OF JUPITER'S FIFTH SATELLITE.

By TAYLOR REED.

A new satellite of Jupiter was discovered by Prof. E. E. Barnard with the great telescope of the Lick Observatory on the night of Sept. 9, 1892. Measures of its position with reference to the planet were obtained on Sept. 10 and following nights. The first announcement gave for its distance from the planet 112,000 miles, and for its period 12 hours, 36 min., which was by some error changed into 17 hours, 36 min. in the European publications. It was stated to be of the thirteenth magnitude, and so a difficult object in the glare surrounding the planet. In a later and more detailed communication to the *Astronomical Journal* the period computed from the distance was given as 11 hours, 50 min.

The satellite was looked for by Prof. Young immediately on his return to Princeton, Sept. 16, and by myself after Sept. 20. It was not seen, at first from the formation of fog shortly after midnight on several good nights, so that the satellite's elongation near two in the morning could not be observed, and later on account of the error in the period of 11 hours, 50 min. It was first seen in Princeton by myself at the Halsted Observatory on the night of Oct. 10.

At the time the satellite was found the

observations at hand were those of Barnard, Sept. 10, 11, 12, 13 and 14, published in the *Astronomical Journal*, No. 275, and one by Barnard, Sept. 23, communicated by him to Prof. Young by private letter.

In reckoning the time of elongation the erroneous period of 11 hours, 50 min. was used without noticing its inconsistency with the observation of Sept. 23. The satellite was actually found on the opposite side of the planet from that indicated by this period. It was first seen a little before midnight. The four bright satellites were then all on the western side of the planet, while the faint satellite was on the eastern, so that the planet and the bright satellites could be hid behind a single occulting bar. An eyepiece was inserted, on the field lens of which a piece of blue glass was cemented, so that when the planet was brought partly out from behind the occulting bar the edge seen through the blue glass was not bright enough to drown out the satellite. Rough measures were made by putting the micrometer wire (unilluminated) first on the limb of the planet and then on the satellite. These were taken primarily for the purpose of ascertaining whether the body relative to the planet was that of a star or that of a satellite. They gave the following results:

Oct. 10 E. S. T.	Dist. fr. Limb.	Dist. fr. Centre.
13 ^h 3. ^m 7	36."5	61."9
13 13. 9	36. 3	61. 7
13 49	31. 2	56. 6

It was estimated that elongation occurred at $12^{\text{h}} 40^{\text{m}} \pm 10^{\text{m}}$. The satellite was lost in the glare of the planet quite suddenly about $13^{\text{h}} 55^{\text{m}}$.

Under favorable circumstances the satellite is not a very difficult object in the 23-inch telescope. The observations seem to warrant the belief that it ought to be seen almost surely in instruments of eighteen or twenty inches aperture and possibly with fifteen inches.

It was seen on the night of Oct. 11, when the atmosphere was quite thick; and with a sky even worse on Oct. 13, when it was shown to several others.

The observations here on Oct. 10, 11 and 13, and Barnard's observation of Sept. 23, seem to demand a period very close to 11 hours, 57 min. Barnard's period of 11 hours, 50 min. entirely fails to satisfy them.

Seven satellites have been discovered this century by four observers. It is an interesting circumstance that four of the seven have been discovered by three Americans.

THE RE-DISCOVERY OF THE TILE FISH.

By WILLIAM LIBBEY, Jr.

The temperature work of the past three summers has borne its first fruits in the re-discovery of this valuable food-fish, supposed to have become extinct.

As its reappearance was predicted upon the basis of the observations made by our party it gives a very positive proof of the value of the work; and further the record of the process by which the conclusion was reached is interesting as it gives another instance of the practical application of a rather complex and abstruse piece of scientific work.

This fish was first discovered in 1879 by a Gloucester fishing-schooner which secured

a large number of them. Specimens were sent to fish experts and the markets, and it was at once recognized as a fish of value for its food qualities. As it was found within a few hours sailing distance of New York, the fishermen saw that it gave promise of an important additional fishing ground. The Fish Commissioner, realizing the important nature of the discovery, began a careful investigation of the entire region in order to determine the extent of the grounds, the abundance of the fish and the best means of catching them. The investigation was pursued during the summers of 1880 and 1881, specimens being taken on nearly all the trips made by the Commission vessels to this region. The result of these trips showed that the fish were abundant, and that the hopes based upon the discovery were well founded.

In the spring of 1882, however, enormous quantities of this fish were found dead upon the surface of the ocean, from Nantucket to Cape May, and since that time none of them have been taken, despite the efforts put forth at frequent intervals to find them.

In 1889 a systematic study of the relations of the Gulf Stream and the Labrador Current was instituted by the Commissioner, Col. M. McDonald, under the charge of the writer, with the idea of establishing a connection between the changes in the temperature of the water and the movements of the schools of fish.

The first report, that for 1889, has already appeared, and that for 1890 is in press.

One of the peculiar features developed by the study of the serial temperatures was the existence of a deep warm water band, lying between the depths of 70 and 100 fathoms. This band was found to be a projection laterally from the deeper portion of the warm water of the Gulf Stream, extending toward the edge of the

continental platform. It appeared that the point of this extension was approaching the angle of the continental platform nearer and nearer each year. In 1889 the 50° F. temperature curve which seemed to be the boundary of this warm band, did not touch the edge of the platform at any point. In 1890 it did so in several points along the portion of the coast south of Martha's Vineyard in the latter part of the summer. In 1891 the contact occurred earlier in the season and at more points than in the previous year, but they were still confined to the easterly portion of the area we were studying and only in a few instances did we find a contact at the continental edge south of Block Island, and then only late in the season, during the last few days of August.

These observations showed that the motion of this band had been progressive, and that if this were to continue, the whole edge might be covered by this warmer water, thus brought in from the main body of the ocean. The contact of this warm water with the bottom at the edge of the continental platform, could not but produce important results by the modification of the temperature conditions of the water. The change of nearly 10° in temperature at such a depth would without doubt completely modify the character of the life to be found there. The change would be the equivalent of a movement of from 700 to 1000 miles in a southerly direction.

Judging further, from the rate of progression and taking for granted that the conditions, physical and mechanical, were the same to the westward, it was anticipated that we would find the edge completely covered by this warmer water. The bearing of this upon the problem is easily seen when it is understood that by such means the feeding ground of fish needing the temperature of 50° F. and

above for their comfortable existence would be enormously extended, and that any fish inhabiting such a band would find their way to the northward and eastward until they reached the point where this warm band left the continental edge, which would naturally occur to the eastward of Cape Cod.

In order to account for the disappearance of the tile-fish in 1882, the following theory was advanced. Suppose that during the period in which these fish were formerly found upon this area there had been a similar progressive movement of this body of warm water toward the continental edge, and that by a reversal of the conditions which had established this motion, the motion had been reversed in 1882; then, the first point at which this warm band would leave the edge would be found in the great bend of the coast southeast of New York, which we have already noted as being the last to be touched by the warmer band in its landward motion. The correspondence of this area with that covered by the dead fish in 1882 is too striking not to deserve mention.

The consequence of this recession of the warm band of water would be that the fish who had found their way to the eastward upon this area would be subjected to conditions which would bring about the result accomplished, namely, their wholesale destruction by the sudden lowering of the temperature of the water.

These deductions having been made upon the basis of our three years work, preparations were made to test the theory practically by fishing along the area covered by water of 50° F. and above, on the edge of the continental platform. It was hoped that the fish would either be found at some point southeast of New York on the area covered by the warm water, or if the whole continental edge were covered

that they would be caught once more upon the ground where they were originally discovered.

During the first week in August the test was made, and the fish was taken south of Martha's Vineyard. The work was continued until Oct. 15th, and the fish were caught over the entire area from the above-mentioned point to a position about 50 miles south of Cape Henlopen.

Observations were made in such a way as to enable us to obtain a map of the area covered by this warm water. The fish were not found in large numbers, but it is believed that next year—if the conditions are the same—the schools thus announced by their advanced guard will put in an appearance.

The Tile-fish (*Lopholatilus chamaeleonticeps*) has many peculiarities of its own which would enable even a casual observer to distinguish it from any other species of our northern waters. In size it varies from 5 to 50 lbs; its head is proportionately large—somewhat resembling the dolphin and wolf-fish. The body is well formed, quite stout at the tail like the salmon, and its general make-up indicates that it is a rapid swimmer.

It is most distinguished, however, by the nuchal crest, or adipose dorsal fin just in front of the spinous dorsal; and its peculiar color, a blue or violet color above, white below, with some areas of yellow; the darker portion of the fish being thickly covered with scales of a brilliant yellow, which give it the tessellated appearance from which the fish derives its name. The fish is a member of the family *Latilidae*, and is most nearly related to the genus *Latilus*. There are three species known, all of which inhabit tropical and warm seas.

THE EVOLUTION OF THE PREMOLAR TEETH.

By W. B. SCOTT.

Cope and Osborn have followed out the development of the molar teeth from the simple primitive form, a slender cone, and the latter has proposed a system of nomenclature for the cusps or elements of the molar crown, founded upon the order or succession in which these cusps make their appearance and their position with reference to the primary cone. I have elsewhere pointed out that this order, and in consequence this nomenclature, does not apply to the premolars, and that, assuming the correctness of Osborn's system, the cusps of the premolars are not homologous with the corresponding ones of the molars, even where the two classes of teeth display crowns of precisely similar patterns. Inasmuch as the premolars are in general of a much less complex pattern than the molars, and in any case they have attained full development long after the latter, it becomes easy to follow out step by step the evolution of these teeth. For this purpose the many marvellously complete phyletic series of mammals which have been found in the lacustrine Tertiary formation of the West, afford most satisfactory material. For the molars this is not the case, because these teeth had already reached the tributercular stage in the lowest Eocene, or Puerco, and before that time the mammals are found but very scantily and but badly preserved.

The development of the premolars from the simple to the complex form is not always the same in all cases. Even in the same animal the order of succession in which the various cusps appear is frequently different in the different teeth. It will be necessary, therefore, to select some one tooth as a standard,

according to which the various cusps may be named. So far as I have been able to observe, the fourth upper premolar always follows a certain order in the addition of new elements, and accordingly will be selected as the standard.

The primitive form of tooth in the premolars, as in the molars, is the simple cone. Obviously this element must be homologous in both categories of teeth and may be called in the upper premolar, as Osborn has proposed for the molar, the protocone. As soon, however, as a second element is added, an important difference between the molar and premolar crown is observable; viz., that in the former the protocone is placed at the *antero-internal* angle of the crown, and in the latter at the *antero-external* angle. In the premolar the first element which is added to the protocone, appears upon the internal or lingual side of that cusp, occupying a position which corresponds to the molar protocone, but which is clearly not homologous with it; this cusp may be called the deuterocone. The next stage of premolar development consists in the addition of an external cusp, posterior to the protocone; this corresponds to the metacone of the molar, but obviously is not homologous with that element, for its position with reference to the protocone is altogether different; it may be called the tritocone. The last step in the formation of the quadritubercular molariform premolar consists in the development of a postero-internal cusp, which may be called the tetartocone, and which represents the hypocone of the molar crown. Conules corresponding to the proto- and metaconules of the molar may make their appearance and may develop into transverse crests, fusing with both the external and internal cusps. In short, the premolar may become altogether molariform, as, for example, in many perissodactyls,

but the order in which the new cusps are added and their relations to the primary cone are not the same as they are supposed to be in the molars.

As already mentioned, the premolars are not entirely constant as to the order of succession of the cusps, though there appears to be no reason to doubt that they are homologous throughout. One exception to this statement should be made for the inner crescent of the anterior upper premolars of certain artiodactyls. Typically this crescent is formed by the extension of the deuterocone, but in the cases mentioned it is developed from ridges advancing from the anterior and posterior margins of the crown, which finally meet and coalesce in the middle line.

The inferior premolars exhibit even more variety in the order of succession of the cusps than do the upper ones, though the homologies of these elements are given with sufficient clearness by their relations to the primary cusp or protoconid. Usually the first new element to appear is the posterior basal cusp, which will eventually become the external part of the talon and thus corresponds to the hypoconid of the molar; but if Osborn's view of the genesis of the molar crown be accepted, this element is homologous with the metaconid, as appearing originally on the posterior side of the protoconid. The second addition may be the anterior basal cusp, which both in position and in homology is equivalent to the paraconid. On the inner, or lingual, side of the protoconid arises a cusp which though having the same position as the molar metaconid, is nevertheless the homologue of the deuterocone of the upper premolar and may therefore be called the deuterocoid. The last of the principal cusps to appear is generally, though by no means always, the postero-internal one, upon the lingual side of the metaconid, which may be

called the tetartoconid; its analogue in the molar crown being the entoconid. The following table will show the correspondences of *position* (not homology) of the molar and premolar cusps:

UPPER JAW.

Molar.	Premolar.
Protocone =	Deuterocone.
Paracone =	Protocone.
Metacone =	Tritcone.
Hypocone =	Tetartocone.

LOWER JAW.

Molar.	Premolar.
Protoconid =	Protoconid.
Paraconid =	Paraconid.
Metaconid =	Deuteroconid.
Hypoconid =	Metaconid.
Entoconid =	Tetartoconid.

This table makes clear two important facts: (1.) The correspondence in homology and position between the cusps of the molars and premolars is much closer in the lower teeth than in the upper. (2.) There is not that reversal in the position of the cusps between the upper and lower premolars which is supposed to obtain in the case of the molars. In the latter the protocone occupies the antero-internal angle of the upper tooth, while the protoconid is at the antero-external angle of the lower tooth. In the premolars, on the other hand, the primary cone is in both upper and lower teeth placed at the antero-external angle of the crown.

Taeker and Röse have recently investigated the development of the molar cusps from an embryological standpoint and have reached conclusions opposed to those of Osborn as to the homologies of these elements. For the premolars the results of embryology agree entirely with those which I had reached by a comparison of the phylogenetic series. These results, however, appear to show that there is not that discrepancy between the mode of development of the premolar and molar elements which has been supposed to obtain.

There is no space to enter upon a discussion of these embryological questions, nor to show why they cannot be regarded as altogether conclusive. Should it eventually prove to be the case that molars and premolars agree in the homologies and order of succession of their component cusps, then the nomenclature of the premolar cusps here proposed may be withdrawn, and by somewhat changing the names now given the molar elements, the two may be brought into complete agreement.

THE GENERA OF AMERICAN CREODONTA.

By W. B. SCOTT.

This extinct group of flesh-eaters is difficult both to define and classify, owing to the lack of diagnostic characters and to the minute steps of gradation by which they shade into other groups of ungulates. More especially is this true of the earliest genera of the order yet discovered, those of the Puerco, which are known, for the most part, only from the teeth, and the tritubercular molar pattern being common to almost all Puerco forms, the proper reference of these genera becomes extremely difficult. The following arrangement of the order into families and genera can obviously, therefore, be regarded only as tentative.

I. Fourth upper premolar not forming a sectorial. Sectorials present, if at all, in more than one pair.

1. Superior molars tritubercular, not trenchant; cusps erect and sharp; inferior molars tuberculo-sectorial, with trigonid raised moderately above the talon and not forming a shearing blade....

Oxyclaenidae.

2. Superior molars quadritubercular: trigonid of lower molars little or not at all higher than the talon, with paraconid

much reduced or absent; all cusps low and massive. Premolars high and acute.

...*Arctocyonidae*.

3. Superior molars tritubercular, with low massive cusps, but sometimes a well developed hypocone on \underline{m}_2 . Trigonid much higher than talon, but not shearing in form; paraconid reduced....

Trisodontidae.

4. Superior molars tritubercular, not trenchant; lower molars with metaconid rudimentary or absent. Astragalus grooved.

Mesonychidae.

5. Upper molars tritubercular and somewhat trenchant, para- and metacones closely approximated, and a cutting crest posterior to the latter; inferior molars with elevated trigonid forming a trenchant blade.

Proviweridae.

6. Para- and metacones connate, protocone reduced or absent, and posterior ridge very large. Talon of lower molars and metaconid small or wanting, proto- and paraconids enlarged, flattened, forming a shearing blade.

Hyenodontidae.

7. Upper molars without posterior blade: para- and metacones separate, very high and acute; inferior molars with well developed metaconid and a shearing blade formed by the para- and metaconids....

Palaeonictidae.

II. Fourth upper premolar and first lower molar forming the single pair of sectorials, upper molars tritubercular, lower, except \underline{m}_1 , also tubercular.

Miacidae.

OXYCLENIDÆ FAM. NOV.

The genera associated together to form this family are known almost entirely from their dentition and their relations are very obscure. Future discovery may well show that some of the forms referred to the family are not creodont at all.

Oxyclenus Cope. (Syn. *Mioclenus* Cope, in part). Upper premolars simple, com-

pressed trenchant cones, except \underline{p}_4 , which has a deuteriocon. The molars are tritubercular and have very acute cusps, but are not trenchant; no hypocone, but very distinct proto- and metaconules, \underline{m}_2 is the largest of the series and \underline{m}_3 very small. Puerco.

Chriacus Cope. Upper premolars compressed and trenchant, \underline{p}_3 & \underline{p}_4 with deuteriocones; upper molars triangular in shape and much extended transversely; \underline{m}_1 has a hypocone, \underline{m}_2 both hypocone and protostyle, while \underline{m}_3 has neither. Anterior lower premolars simple and compressed, but \underline{p}_4 has a talon and deuterioconid. In the molars the trigonid is much higher than the heel, which is composed of three cusps. Puerco.

Protochriacus gen. nov. (Syn. *Chriacus*, Cope, in part). This genus differs from the preceding one in the simplicity of \underline{p}_3 and in the absence of the protostyle in \underline{m}_2 . In the lower molars the trigonid and talon are of nearly equal height. Puerco.

Epichriacus gen. nov. (Syn. *Chriacus* Cope, in part). In this genus \underline{m}_2 is constructed as in *Chriacus*, but \underline{p}_4 has all the elements of a molar, though not fully developed. The third molars in both jaws is very much reduced. Puerco.

Pentacodon gen. nov. (Syn. *Chriacus* Cope, in part). Talons of lower molars without entoconid; hypoconid and hypoconulid very acute; \underline{m}_3 largest of the series. Puerco.

Loxolophus. Cope. (Syn. *Chriacus* Cope, in part). Superior molars trigonodont with very minute hypocone, and remarkable for their antero-posterior as compared with their transverse extent. Lower molars with a high trigonid, composed of three well-developed cusps, and basin-like talons, with elevated hypoconid. Puerco.

Tricentes. Cope. Teeth very much as in

Chriacus, but with only three upper premolars. M_1 & 2 nearly quadrate in outline, produced by the well developed hypocone; m_3 has no hypocone.—Puerco.

Ellipsodon gen. nov. (Syn. *Tricentes* Cope, in part). This genus, the systematic position of which is very doubtful, agrees with *Tricentes* in having but three upper premolars. The upper premolars are relatively broad and massive, p_4 especially so, and with very large deutercone. The molars are oval in shape and have no hypocone; m_3 greatly reduced, forming a mere oval rudiment without recognizable elements. Puerco.

ARCTOCYONIDÆ. Cope.

Clænodon gen. nov. (Syn. *Mioclænus* Cope, in part). The separation of this genus from the European *Arctocyon* is of very doubtful validity, though the upper molars are less completely quadritubercular and less covered with tubercles. The inferior premolars are weak and simple, but p^4 is quite large and has anterior and posterior basal cusps. The lower molars are longer and narrower than the upper, the talon longer than the very low trigonid, and the paraconid reduced or absent.—Puerco.

Tetraclænodon gen. nov. (Syn. *Mioclænus* Cope, in part). The lower molars of this genus resemble those of the preceding one, but the premolars are larger and p^4 has all the elements of a molar.—Puerco.

Anacodon. Cope. This genus was originally referred to the Condylarthra, but it has lately been shown by Osborn to be more properly referred to the present family of creodonts. The premolars are very small and reduced to two or three in number; the molars are of quadrate shape, very low and covered with numerous accessory tubercles.—Wasatch.

TRIISODONTIDÆ. Fam. Nov.

Triisodon. Cope. P^4 very large, with well developed bicuspid talon; trigonid of lower molars rising considerably above talon; a small and low metaconid and still smaller and lower paraconid; the two latter on the same antero-posterior line; talon with large hypoconid and three small internal cusps.—Puerco.

Goniacodon. Cope. Anterior upper premolars small and simple; p^4 with deutercone; upper molars triangular with low conical cusps, m^1 with hypocone; m^3 very small. In the lower molars the trigonid is moderately raised above the talon; proto- and metaconid closely approximated and form a twin cusp; paraconid very small, depressed and submedian in position; talon basin-shaped.—Puerco.

Microclænodon gen. nov. (Syn. *Goniacodon*. Cope, in part.) Trigonid as in the foregoing genus, but talon without entoconid.—Puerco.

Sarcothraustes. Cope. The largest of the Puerco creodonts are to be found in the species of this genus. The upper premolars and molars closely resemble those of *Goniacodon*; m^3 is oval in shape, having lost the metacone, and much reduced in size. The anterior lower premolars are remarkably small and simple; p^4 very much larger and higher, with bicuspid heel. The trigonid of the lower molars differs in construction from that of *Goniacodon*, but the talon is similar to that found in that genus; the protoconid is much the largest cusp; the para- and metaconids are much reduced and placed on the same fore and aft line. On m^3 the hypoconulid may or may not be enlarged.—Puerco.

MESONYCHIDÆ. Cope.

Dissacus. Cope. P_3 has a deutercone and p_4 is completely molariform; the

upper molars are tritubercular and very simple. The lower premolars consist of a high, acute and recurved protoconid and a low trenchant heel. In the molars the metaconid is almost completely fused with the protoconid and the paraconid is rudimentary; the talon consists of the hypoconid only, which is trenchant.—Puerco.

Pachyaena. Cope. $I \frac{3}{2}$, $C \frac{1}{1}$, $P \frac{4}{4}$, $M \frac{3}{3}$. Upper teeth like those of *Dissacus*, except for the reduction of the metacone, which is absent from m_3 . In the lower molars the metaconid has become indistinguishably fused with the protoconid.—Wasatch.

Mesonyx. Cope. (Syn. *Dromocyon*. Marsh). $I \frac{3}{2}$, $C \frac{1}{1}$, $P \frac{4}{4}$, $M \frac{3}{3}$. Differs from *Pachyaena* in the loss of the third upper molar, and the larger size of the metacone.—Bridger to White River.

PROVIVERRIDÆ. Schlosser.

Deltatherium. Cope. (Syn. *Lipodectes*. Cope). $I \frac{3}{2}$, $C \frac{1}{1}$, $P \frac{3}{3}$, $M \frac{3}{3}$. Talon of inferior molars trenchant and without entoconid; p^4 molariform. Cutting ridge on upper molars, posterior to metacone very small and not separated from that element.—Puerco.

Sinopa. Leidy. (Syn. *Limnocyon*. Marsh. *Prototomus*. Cope. *Stypolophus*. Cope). Dentition unreduced; p_2 with a small deutercone, p_4 like the sectorial of the dog, but very small. In upper molars the posterior cutting ridge is enlarged and detached from the metacone. In the lower molars the trigonid forms a very high shearing blade; talon reduced and basin-shaped.—Wasatch and Bridger.

Didelphodus. Cope. $P \frac{3}{3}$, $M \frac{3}{3}$. Molars as in *Sinopa*, p_4 simpler than in that genus, being without tritococone.—Wasatch.

HYÆNODONTIDÆ.

Oxyæna. Cope. $I \frac{3}{2}$, $C \frac{1}{1}$, $P \frac{4}{4}$, $M \frac{2}{2}$. P_2 & 3 have deuterococones and p_4 is a well-

developed sectorial, with very large deutercone and trenchant tritococone. M_1 is exaggeration of that found in *Sinopa*; the protocone is somewhat reduced, the para- and metacones very closely approximated and the posterior cutting ridge greatly enlarged. M_2 is transversely extended and very short from before backward. In the lower molars the trigonid forms a very efficient sectorial blade, but retains the metaconid; the talon is small and basin-shaped.—Wasatch.

Protopsalis. Cope. (Syn. ? *Limnofelis*. Marsh). This genus is imperfectly known, but obviously nearly allied to *Oxyæna*, from which it differs in the lower molars; m_1 has both metaconid and talon, m_2 has lost the former and retains only a rudiment of the latter.—Bridger.

Hemipsalodon. Cope. This form, the largest of all known creodonts, is very close to the European genus *Pterodon*, from which it differs in the large size and basin-shape of the talon on m_3 .—White River.

Hyænodon. de Lais. and Par. $I \frac{3}{2}$, $C \frac{1}{1}$, $P \frac{4}{4}$, $M \frac{3}{3}$. P_4 is much less completely developed as a sectorial than in *Oxyæna*. M_1 has lost the protocone, the para- and metacones are almost connate and the posterior blade is greatly enlarged. In m_2 the para and metacones are indistinguishably fused. In m_1 the metaconid has disappeared, but a rudimentary talon remains. M_2 is similar, but larger, while m_3 consists of proto and paraconids only, resembling the lower sectorial of the cats.—White River.

PALEONICTIDÆ.

Paleonictis. de Blainville. The very interesting discovery of this European genus in the American Wasatch has recently been announced by Osborn. $I \frac{3}{2}$, $C \frac{1}{1}$, $P \frac{4}{4}$, $M \frac{2}{2}$. $P_{2,3}$ & 4 have deuterococones, and p_4 has three external cusps,

thus presenting a rudimentary imitation of the cat's sectorial. M_1 is strictly trigonodont; the cusps are all very high and acute; the para- and metacones show no tendency to coalesce and there is no posterior trenchant crest behind the metacone. M_2 is very small, a mere oval rudiment. In the lower molars there is an efficient sectorial blade, but a well developed metaconid is retained, and the talon is small and basin-like; on m_2 it is much reduced.—Wasatch.

Ambloctonus. Cope. P_4 , M_2 . M_1 differs from that of *Palaeonictis* in the reduction of the protocone, closer approximation of the para- and metacones, and the elevation of the cingulum at the postero-external angle of the crown. M_2 has, apparently, lost the metaconid and the talon is rudimentary.—Wasatch.

Patriofelis. Leidy. (Syn. *Oreocyon*. Marsh). $I_2^?$, C_1 , P_3 , M_2 . Premolars massive and having a talon. M_1 has a talon, but m^2 has neither metaconid nor talon, but is composed of proto- and paraconids only. Bridger.

MIACIDÆ. Cope.

Didymictis. Cope. $I_2^?$, C_1 , P_4 , M_2 . P_4 is a fully developed sectorial, and as in the cats, viverrines, etc., it has a protostyle. M_1 is triangular, but the antero-external angle of the crown is extended and the cingulum raised into a cusp; there is no hypocone or metacone. M_2 is much smaller, without hypocone or conules. M_1 has a remarkably high trigonid, and the shearing surface is rather anterior than external; the talon is low and basin-shaped. M_2 is very small and of tubercular pattern.—Puerco to Bridger.

Miacis. Cope. (Syn. *Urtacyon*. Leidy. ? *Vulpavus*. Marsh.) Superior dentition unknown; inferior not reduced in num-

ber. In m_1 the trigonid is much lower than in *Didymictis*, the proto- and paraconids more flattened and forming a more efficient shearing blade; the talon is basin-shaped. M_2 & 3 much smaller and tubercular.—Wasatch and Bridger.

CREODONTA INCERTÆ SEDIS.

Mioclenus. Cope. This name should be restricted to those forms which agree with the type species, *M. turgidus*, in having very low and massive premolars. The systematic position of the genus is altogether uncertain; the premolars suggest relationship to the condylarthrous family, *Periptychida*, but on the other hand, the molars are of quite a different type. This obscurity cannot be removed until the foot-structure of the genus has been determined. Puerco.

Paradoxodon, gen. nov. (Syn. *Chriacus*, Cope, in part). Upper teeth unknown. Lower premolars extremely narrow and compressed. Molars increase in size posteriorly and the trigonid rises but little above the talon. In m^1 the proto- and metaconids are of about equal size and on the same transverse line, and the former shows a tendency to become crescentic; the paraconid is much reduced; the hypoconid is also somewhat crescentic, the entoconid lower and more conical. In m^3 the trigonid is curiously asymmetrical, which is caused by the backward projection of the metaconid, the larger size of the paraconid than in m^1 and the greater prominence of the ridge connecting that element with the protoconid; the hypoconulid is enlarged and carried on a distinct fang. The pattern of these teeth strongly suggests that more perfect material will show the genus to be related to the primitive artiodactyls.—Puerco.

The genera, *Onychodectes*, *Conoryctes*, *Hemiganus*, of the Puerco, and *Esthonyx*,

of the Wasatch, should probably be removed from the creodonts and brought into relation with the tillodonts.

COLERIDGE'S NOTES ON HORACE.

By ANDREW F. WEST.

Coleridge's habit of scribbling *marginalia* in his friends' books and his own is well known to every one who has given any study to his life. Both their quantity and their value were early made the subject of remark by Charles Lamb, and have received attention ever since. Lamb knew whereof he spoke, when he confidentially advised the book-lover to be chary of lending his books, excepting to "such an one as S. T. C.," for "he will return them (generally anticipating the time appointed) with usury; enriched with annotations tripling their value." In Lamb's own favorite copies there was legible proof of this in the "many precious MSS." of S. T. C., "in matter oftentimes, and almost in quantity not unfrequently, vying with the originals," and all scribbled "in no very clerkly hand."*

When S. T. C. got hold of a book of pure literature, his spirit of phantasy or humor or conjecture, of appreciation or mildly vamping indignation, or what not, promptly began to stir with his reading. It was then that his musings were very apt to take wing and alight outside the text, settling all over the margins. It is little wonder, therefore, that the *marginalia* of so eminent a critic and poet should be the subject of general literary curiosity and of steady collection by the British Museum.

One of his most cherished books, which has received no public notice as yet, has been in my possession for a time, through the courtesy of Mr. Beverly Chew of the Grolier Club of New York. The borders

of its pages are covered from first to last with Coleridge's loosely scribbled spluttering notes, "in no very clerkly hand" at best, and often wholly illegible. However, I have transcribed all that I can make out and present here a copious selection of them, chiefly as showing his literary appreciation of Horace and his own personality as well.

The book is his pocket copy of Horace, his constant companion for the last twenty years of his life. In 1872 it was given by the Rev. Derwent Coleridge, his son, to Mr. Augustus Swift of New York, the following being entered on the fly-leaf in Derwent Coleridge's hand:

Hoc, libellum
reliquias, patris, desideratissimi
Augusto M. Swift
alumno amico
d. d.

Derwent Coleridge

Hanwell, Cal. Aug. :—MDCCC.LXXII.

The size of the pages is three and a half by five and a half inches, and the thickness of the book a trifle over half an inch. It contains in its three hundred and twenty-five dingy little pages the whole of Horace.

It was published in London in 1637. The printing is wretchedly done. Around the text on the outer and lower edges of the pages are printed marginal notes in very small roman type, with here and there in the text a word capriciously put in italic capitals, and in the notes an occasional English word or phrase standing forth in large black-letter. The editor was Doctor John Bond, one of the best English classical annotators of the end of the sixteenth century and a scholar of sufficient repute in that time to be styled in his florid epitaph:

Eloquiū splendor Pieridumque decus.

His Horace went through at least fifteen editions, the copy belonging to Coleridge

* *Essays of Elia* :—The Two Races of Men.

being of the sixth. The date and place of the printing (London, 1637,) are the date and place of the decree in Star Chamber prohibiting the importation of foreign type and limiting the number of printing offices,—quite enough to account for the poor typography of this copy. Moreover, as the editing by the time Coleridge got the book was as obsolete as the printing was bad, the contrasted excellence of his scribbled notes over the book he was annotating is all the more noticeable.

The last owner of the book before Coleridge was possibly Boyer (or Bowyer), his teacher during his pupillage at Christ Church Hospital. The copy had been marked for destruction by the word "Waste" in large letters on the title-page. Coleridge either saved it from the waste-basket or found it at some book-stall and subsequently had it clothed freshly with the "new coat of skins," of Hayday's binding, in which it still remains.

The *marginalia* of Coleridge begin on the ninth page with a general note, part of which is here transcribed:

"This antient drudge, which doubtless has served many masters since 1637, is the only memorial that I possess of the poor, clever, generous, noble-hearted, wrong-headed — Boyer (?) *. Tho' mark'd for waste, it is one of the last of my books that I will part with. I must afford it a new coat of skins. Yet shall its present mantle be well saved as the youthful hose of the lean and slippered pantaloon. Who knows but it may have accompanied some loyal scholar to the execution of K. Charles. It may have been fumigated in the great plague and narrowly escaped combustion in the great fire. It has seen regicide, republic, protectorate, restoration, revolution, change of dynasty, reform and free trade; nine kings, two or three queens

regnant, and two protectors, one king beheaded, one abdicated and one (at least) lunatic. It may possibly have been in the hands of Jeremy Tayler or of Milton. It may have helped Busby to an excuse to flog."

Later in the note, Coleridge has accidental occasion to comment on a passage from Suetonius, whom he characterizes as "no more than a parcel-gilt writer in point of diction, no purer in style than a cheap (?) novelist (?), yet withal a writer greatly to be recommended to all admirers of monarchy."

Then follow his separate notes on the text. A full selection is here given of the legible notes, Coleridge's language being invariably indicated by quotation marks.

ODES.

Book I.

ODE

I. [*Mæcenas atavis*]

"It was manifestly composed to stand like a picquet" (= picket) "before the collection and is about as such things generally are."

A view well borne out by the later theory that in this ode Horace merely took an old poetic exercise, to which he prefixed two lines to Mæcenas and added two more of the same kind at the end,—making the revamped effusion serve as a preface.

III. [*Sic te diva potens*]

"Imitated by Dryden and addressed to Roscommon on his voyage to Ireland. It is pleasant as a memorial of Horace's affection for Virgil." Coleridge has underscored *animæ dimidium meæ* and opposite *Acroceraunia* has written "Byron," in evident reference to the lines in Childe Harold:

The Acroceraunian mountains of
old fame
The thunder-cliffs of fear.

* (?) indicates uncertainty, due to illegibility of Coleridge's writing.

He also has as a footnote on

ecumque ipsum petimus stultitia

"This line is capable of a physical and a spiritual application, 1st to Aeronauts; 2d to Fanatics. Neither were probably in the mind of Horace." The "Aeronaut," however, was in Horace's mind, in the instance of Daedalus, though perhaps not as "a spiritual application."

IV. [*Solvitur acris hiems*].

"Very sweet."

VI. [*Scriberis Vario fortis*].

"No great shakes."

VII. [*Laudabunt alii*].

On *uda Mobilibus pomaria rivis* Coleridge notes "a very beautiful image."

IX. [*Vides ut alta*].

Of *Diota*, the two-eared jar, he says, "I think I have read of a two-lugged quaigh, which would render *Diota* more exactly."

XII. [*Quem virum*].

Of *occulto ævo* he writes, "I do not see the propriety of this simile. The fame of Marcellus was a little occult as any body's."

The point, however, is that the fame of Marcellus has in it a slow silent growth like that of a great tree increasing insensibly, *occulto ævo*, in the unnoticed lapse of time.

XIII. [*Quum tu Telephū*].

"This Telephus seems to have been a dangerous youth. He is mentioned IV. 11," and in other places.

XIV. [*O navis referent*].

"I have little doubt that this allegory is aimed at Sextus Pompey."

XV. [*Pastor quum traheret*].

On *earmina divides* he writes, "The nightingale they say makes sweet division."

On *non . . . respicis*, "seest thou not behind thee." Very good for the way

retreating Paris would glance back over his shoulder at his pursuers.

XVII. [*Velox amœnum*].

"*Vitreum Circen*. Does this epithet imply the frailty of Circe? Or is it an Hyperbole like 'transparent Helena' of Shakspeare? Possibly H., by comparing the enchantress to an artificial production that seemed almost magical, hinted that her beauty was literally in enchantment."

Though it is not perfectly clear what is meant by Coleridge's last phrase, his literary sense in this criticism is surely acute, and better than that of the scholarly commentators. "Glassy Circe" has been a puzzle, and unless the idea of fragility and almost magical brilliancy (as it would seem to the ancients, for Horace applies *vitreus* to the gleam of the sea in sun-light and *splendidior vitro* to the fountain of Bandusia) are involved, it would seem to be insoluble. For the idea of fragility with brilliancy in the sense of deceitfulness, the sentence of Publilius Syrus may be cited:

Fortūna vitrea est: tūm cum splendet frāngitur.

XVIII. [*Nullam Vare*].

The choriambic tramp of this ode displeased Coleridge. "I confess my inability to conceive how this and other less usual metres sounded to Roman ears. To mine as I read them they are rough and offensive."

XX. [*Vile potabis*].

"A very pretty invitation to home-brew'd."

XXII. [*Integer vitæ*].

"I wonder whether this ode is founded on fact. Wolves seldom attack man unless 'by writhing famine roused.' I suspect however that H. must have been singing sadly out of tune."

XXIV. [*Quis desiderio*]

On *Pudor et Justitiæ soror, incorrupta
Fides: and nudaque Veritas.*

"Modesty that looks so shy
And sister she of Equity,
Faith that will not sell her vote
And Truth without a pretty coat."

This seems to be Coleridge's own version, though possibly remembered from some other translator.

"I wish Melpomene and Mercury were out of this ode."

XXV. [*Parcius junctas.*]

"An ugly piece. Old age should be respected even in a worn out Nasidena. The hearts of the Lydias seem to have been the same in Rome as in London."

On *flebis in solo angiportu*: "Gateway Moll."

XXVI. [*Musis amicus*]

On *Rex gelidæ metuatur ore, etc.*:

"Never care a pin or straw for Nicholas, the Russian bear."

XXX. [*O Venus regina*]

"I can't conceive how he could think this ode worth writing."

Book II.

VI. [*Septimi, Gades aditure.*]

On *dulce Galaesi flumen*:

"Virgil* applies to Galaesus the epithet *niger* whether from the depth of shade to which Propertius alludes, or from the black depth of the water; or was Galaesus like Lodore of Southey (?) 'stain'd with peat.' Does *pellitis* mean that the sheep wore body-clothes?"

X. [*Rectius vives Licini.*]

On *informes hiemes* there is note drawn from his own experience:

"I have seen them in Ps. 30.5. His wrath endureth but the twinkling of an eye and in his pleasure there is life; heaviness may endure for a night but joy cometh in the morning. Like but

oh how different. Ovid *Fast.* I. 495 is much like. But he has not improved on Horace."

XII. [*Nolis longa feræ.*]

"Lempriere, with his usual felicity at blundering refers to this ode in his article. *Licinius* seems to read *nolente metro Licinia*" (= *Licymnia*) "and actually supposes that Horace's fair-hair'd kiss-snatching wench was Mrs. Maecenas."

XVI. [*Otium divos.*]

"Prettily paraphrased by Warren Hastings. I have forgotten Warren's paraphrase. Otway's imitation is very poor."

XVII. [*Cur me querelis.*]

"This is a beautiful and tender ode, if due allowance" (is made) "for the astrological allusions in which Horace might be as earnest as Dryden. Compare I. 20. Was this written during the last illness of Maecenas." "I. 20" is the ode mentioning the enthusiastic reception of Maecenas in the theatre after recovery from a severe illness.

XVIII. [*Non ebur neque aureum.*]

"A truly exquisite poem—of whose merits I was hardly aware till St. David's Day, 1825."

XX. [*Non usitata.*]

An ode whose incongruities of taste forced out of Coleridge the expression of his contempt in a facetious emendation of the expression *et album mutor in alitem*. For *alitem* he suggests "*lege Anserem*"!

Book III.

I. [*Odi profanum vulgus.*]

"These lines should be the motto for the Laureate's" (Southey's) "Songs for the royal nursery. His contra-democratic spirit appears in the first line. The . . . attention he requires in the augural phrase *favete linguis, anglice* Hold your jaw * * * * * *Musarum sacerdotes* expresses the Laure-

* Georgics IV, 126.

ate's mischievous principles. The 4th explains his own applicability." "The 4th" verse is *virginibus puerisque canto*.

II. [*Angustam amice*]

"Prior has imitated this ode in a composition of nearly three hundred lines into which he has contrived to interweave Horace ingeniously enough."

IV. [*Descende caelo*].

The unity of this ode seemed to Coleridge somewhat broken by the introduction of the Gigantomachia as sequel to the tribute of Horace to his guardian Muses.

"This ode, of which the former part as far as *gaudetis almae** is exquisite but as far as I can see very loosely connected with the sequel, may have been composed after the defeat of some conspiracy or revolt against Augustus. Perhaps after the conquest of Antony."

"34 *Lactum equino sanguine* is applicable to the Briton of the present day—though not in the same sense as to the Concan."

"80 The Roman writers are little favorable to Theseus or Pirithous."

XII. [*Miserarum est*]

"Ionic a minore—*metrum insequens*."

XV. [*Uxor pauperis Ibyci*]

"I half incline to suggest *sed* instead of *nec* in the last line. There is a certain connection between the casks *poti facce tenus* and the old flirt who like Ariadne and Diana Trapes might find a friend in Bacchus when other lovers had left her." It scarcely needs to be said that this conjecture of *sed* for *nec* is chiefly useful as a warning.

XIX. [*Quantum distet*]

"How came Telephas to be such a favorite with the ladies if his discourse was so chronological."

XX. [*Non vides quanto*]

"Much the worst and most disagreeable ode in Horace."

XXIV. [*Intactis opulentior*]

On *figit . . . summis verticibus clavos*,
"Hit the nail on the head."

"This ode is fine rant. To praise Scythians, Indians, heathen beasts, by way of reproach to Romans, Britons, Xtians, men, is a regular commonplace—but were not the Scythians of the same Tartar race whose hospitality offer'd wife and daughter to the casual visitor! It is altogether much in the vein of Sanford and Merton."

XXIX. [*Tyrrhena regum progenies*]

"Finely imitated by Dryden."

XXX. [*Exegi monumentum*]

On *dum Capitolium*

Scandet cum tacita virgine pontifex

Dicar:—

"Perhaps this sounded haughty, yea impious, to Roman ears. Little was it thought how long the boast was to outlive the rite."

Book IV.

IV. [*Quale ministrum*]

"This speech of Hannibal has been expanded by Prior and put into the mouth of Louis XIV. The fabled descent of the Britons from Troy makes a lucky coincidence, but Louis was not Hannibal."

VI. [*Dive quem proles*]

"This is a most artful and skilfully constructed ode. The author's name is beautifully introduced at the conclusion. A fig for the folks that proscribe egotism."

VII. [*Diffugere nives*]

On *splendida arbitria*: "I do not perceive the usual Horatian felicity in this epithet. Perhaps it is half-ironical, as if to say—When Minos has passed that wonderful judgment they all talk so much about." Coleridge here misses the point, inasmuch as *splendida* is transferred from its primary fitness for

* v. 42.

describing the grandeur of the judgment court of Minos and applied to his decrees.

On *Liberat Hippolytum*: "Here Horace speaks as a free-thinking pagan. The orthodox held that Diana did restore Hippolytus and that Theseus did deliver Pirithous—though Theseus does not appear to have Roman religion."

X. [*Ne forte credas*]

"Measure choriambic as B. 1. 18. H. N. C. remarked that the Greek movement was exotic and unnatural to the Latins. I pretend not to judge, but this ode might be forgotten much to the credit of its author."

The "Greek movement" is, of course, the chorianbic metre.

XII. [*Jam veris comites*]

"This is a pleasant invitation, for it is pleasant to know that Virgil and Horace were cotemporaries."

XIII. [*Andivere, Lyce*]

"This is another peccadillo neither moral nor amiable."

EPODES.

I. [*Beatus ille*]

On v. 24—*tenaci gramine*: "knot-grass, tedded grass."

v. 27—*obstrepunt*: "sough."

v. 39—*in partem juvet*: "bear a side."

v. 66—*renidentes Lares*: "silver-salt."

III. [*Parentis olim*]

v. 3—*cicutis allium nocentius*: "I honor Horace for hating garlic."

IV. [*Lupus et agnis*]

v. 5—*superbus pecunia*: "purse-proud."

v. 12—*præconis*: "beadle."

VI. [*Quid immerentes*]

v. 16—"Libellers are much the same now as in the days of Cassius Severus, prone to attack, inveterate cowards

against the bold, and ready to catch at hush-money."

XIII. [*Horrida tempestas*]

"This ode should be distributed into staves of three lines. The metre sounds ill to me."

XVI. [*Altera jam teritur*]

v. 10—"O thou will be a wilderness again

Peopled with wolves, thy old inhabitants."

v. 18—"Herod. 1. 163. Part of the *execrata civitas* did break their oaths."

v. 57—"Where did Horace expect to find such a lubber-land? Schlummerland. Pays de Cocagne! He must have heard of the bread-fruit."

SATIRES.

Book I.

I. [*Qui fit, Maecenas*]

On v. 15—"Gay has a good fable on this idea."

v. 29—*Perfidus hic caupo*: "I hence infer that Ovid" (surely a slip for "Horace") "had been called into a reckoning many a time. Le mauvais quart heure."

v. 85—*vicini oderunt*: "I believe this happens."

II. [*Ambubaiaarum collegia*]

"Poor Joe Walton for inserting Pope's imitation of this satire in his edition, gave Matthias an opportunity of being as moral and as testy as an old maid."

IV. [*Eupolis atque Cratinus*]

"This satire is an ingenious defence of satire in which the satirist modestly praises himself and gives a fresh cut to those that are smarting also."

On v. 9—*emunctæ naris*: "a delicate metaphor showing the high

importance of the muck-ing-can."

v. 83—*famamque dicacis*: "Disent des bon mots, mauvaise caractere. Pascal."

v. 105—"I do not approve at all of old Mr. Horace's method of moral institution which is too common with professing Christians."

v. 143. *Judaei*: "Fates render it impossible that Jews should be confounded with Christians, but the allusion is not clear." The allusion is to the tendency of the Jews to proselytize.

V. [*Egressum magna*]

v. 98—*Gnatia lymphis iratis*: "Would not *nymphis iratis* be a better reading?" Still another instance of the danger of marring the text by trying to mend it. There is no trouble, since *Lympha* in the same sense as *nympha*, "a water-goddess," is good Latin from the time of Varro onward.

VII. [*Proscripti Regis Rupili*]

"I must say England in the most quibbling" (squabbling?) "age never produced anything viler than this classic contest. It is in the worst style of the most scolding scenes of the Old Dramatists."

X. [*Lucili, quam sis*]

"This satire has suggested Rochester's allusion, in which are to be found the often-noted characters of Sedley and the antithetic compliment to Dorset, 'The best good man with the worst natured muse.' Some of the accommodations are apt enough, but the parallel of Dryden with Lucilius is not happy."

Book II.

I. [*Sunt quibus in satira.*] Imitated by Pope.

II. [*Quae virtus est.*]

"Imitated by Pope but not happily. Roman *gourmandise* had but little resemblance to English nor is epicurism a characteristic foible of England."

v. 68—*simplex Nævius*: "Billy Coates."

v. 77—*cena dubia*: "Terence Phormio. A. 2. Scene 1, I doubt not that the phrase was fashionable."

III. [*Sic raro scribis.*]

v. 1—"Scarce twice a poetic month you appear in print. Pope."

v. 44—"The *grex Chryssippi* must have been mad enough if they were like this man, and he like his character in Lucretius."

v. 60—"A pretty theatrical anecdote. Fufius must have been in a deeper dram of drink than ever George Fred. exhibited."

v. 135—"Pro '*auctum*' lege '*actum*.'" A happy yet obvious correction of what may, after all, have been a printer's slip.

v. 183—"Cicer - *Faba* - *Lupini* - would go but a little way towards modern expenses. Nor do I suppose they went far in the age of Horace. The words and perhaps the articles were relics of a cheaper, and not necessarily a better age."

v. 255—"I read the story of Polemo in Sanford and Merten, A. D. 1805."

VI. [*Hoc erat in votis.*]

"Paraphrased by Swift and Pope. The coincidences are very lucky."

v. 20—"Janus presided over the Roman Paternoster Row. His double face well qualified him for the place." Is the last sentence a couplet quoted by Coleridge?

VII. [*Iamdudum ausculto*]

v. 4—*Ut vitale putes*: "I should render it 'worth my keep,' 'I don't eat my head off.'" Then he adds in pencil "Rather life-like, not too good to live."

EPISTLES.

Book I.

I. [*Prima dicte mihi.*]

"Well imitated by Pope, especially the first part."

v. 16—*agilis*: "busy."

v. 21—*opus debentibus*: "authors who have received money in advance."

v. 24—*graviter*: "heartily, with all one's might, in right earnest."

v. 54—"It proves the good sense of the Romans that they made the double-faced god, the tutelary of their Change-alley and Paternoster Row."

Book II.

II. [*Trojani belli scriptorem*]

"Homer might well be a better teacher than Chrysippus—if the latter approved of the marriage of parents and children—of eating dead bodies, etc. *Sed quære*. This may be as true as that he died, like Philemon, of excess, eating figs."

III. [*Juli Floræ quibus*]

v. 9.—"Poets should never promise

fame to one another. Who was Titius?" He is still unknown, except for this solitary mention in Horace.

V. [*Si potes Archiacis*]

"This epistle has been imitated with much prolixity and considerable humour by Swift."

VI. [*Nil admirari*]

"Imitated by Pope. He seems to have pleased himself. The epistle is in his best verse and diction, but it is not satisfactory. The style is so poignant that it seems to require every line to tell. Whatever is plain seems insipid; the weaker parts do not set off but interrupt the hits. They look like patches of brick-work from which the stucco has fallen."

VII. [*Quinque dies tibi*]

"Imitated or rather transcribed by Swift and Pope."

v. 58.—*Lare certo*: "*Libri veterrimi habent 'lare curto'—quod forte melius.*" *Curto* was the reading preferred by Bentley, with some MSS. support. It has not been generally adopted.

X. [*Urbis amatorem Fuscum*]

v. 10.—*Liba recuso*: "Mouldy stew'd prunes and stale cakes."

v. 22, sqq.—"These lines may have suggested a beautiful passage in Cowper's Task."

XIII. [*Ut proficiscentem*]

"How delightful to find Horace punning on a name, and then for a Roman to have such a name." (The name is *Vinius Asina*.) "I like both these and Horace the better."

XV. [*Quæ sit hiems Veliae*]

"This epistle is a fair specimen of plain confession under the garb of irony. Maenius is capital. The swell-feast buffoon to a nail."

v. 15.—*Puteosque perennes*.—"Should not

the *-que* be *-ve*?" The true reading is *-ne*. Coleridge saw the difficulty but not the remedy, though his *-ve* is better than the *-que* he would displace.

XVII. [*Quamvis, Scaeva, satis*]

"There is much quiet wit and some sense in this epistle, though after all it rather smells of the parasite."

v. 37.—"*Sedit*, etc. If you fear falling, best not climb at all."

XVIII. [*Si bene te novi*]

"Whether Horace really meant to recommend attendance on the great to Lollius or to scare him by a strong picture of the insecure and slavish tenure of the great man's friendship is not obvious. He certainly boasts of his own retirement and independence on the banks of Digentia." In v. 35 Coleridge's copy began the line with *Traxerit aut olitoris*, etc. His correct remark is "*Lege. Thrax erit, i. e. Gladiator. Certissima emendatio*," but the emendation may have come from reading some other edition of Horace.

XIX. [*Prisco si credis*]

v. 48.—"I smell a pun. *Ludus* means either play or place of exhibition."

XX. [*Vertumnum Juvumque*]

v. 28.—*Collegam Lepidum quo duxit Lollius anno*: "This was U. C. 733 or before Christ 21. The election of consuls took place while Augustus was absent in Sicily and was attended with much riot and electioneering (*ambitus*). Lollius was originally sole consul, the other place being left open for Caesar's acceptance, but he declined it and Lepidus was appointed after a violent contest. In this year Agrippa, by the

Emperor's command, divorced Marcella and married Julia, from which marriage descended Caligula, Agrippina, and Nero. In nothing has the divine law more signally vindicated itself than in the disastrous issues of antique marriage."

Book II.

I. [*Cum tot sustineas*]

"Well imitated by Pope. But there is much false criticism both in the original and in the imitation. Pope addressed Augustus, though there never was an Augustus in England."

v. 46.—"This line matches in number of elisions Virgil's *monstrum horrendum informe*, etc."

v. 233.—"The few fragments of Chœrilus which I have seen by no means deserve this character."

v. 248.—"I have seen this verse and the two preceding bracketed as if spurious—but they seem to follow aptly enough, and indeed are necessary, or else Horace might be suspected of including Augustus in his censure on royal taste. Pope has omitted them in his imitation, perhaps because no English Augustus had patronized a Virgil or a Varius."

There is enough in these selections to show how assiduous a reader of Horace Coleridge must have been. There is also enough to warrant a judgment as to the value of his notes. They are not uniformly excellent. In his few ventures at text emendation he is at his worst, and his suggestions have nothing notable about them. Where they are right they are so obvious as to call for little insight to make them, and where the difficulty

lies below the surface Coleridge is wrong. There is also a stray slip or two in the interpretation of Horace. The misunderstanding of *splendida arbitria* (Odes IV. 7) is one and the ridicule of the ending of the sixteenth Epode is another. Then too he has much trouble with the unusual metres,—particularly with the choriambic element, which worries him. Yet these are practically all his defects. On the other side we get a considerable amount of criticism, by the time his annotations are put together. His estimates of whole poems are usually sound and very clear; his responsiveness to fine images and touches is quick and spirited; he makes happy hits in translating recalcitrant words and phrases; he sometimes sees at one glance where the real meaning of a puzzling expression lies, (such as *vitrea Circe* in Ode 17 of the first book); his freaks of humor are always amusing and not unfrequently enlightening as to the true meaning of Horace, and his criticisms of Swift, Pope, Dryden, Prior, and other English imitators of Horace, are of course entitled to great respect.

The extent of his contribution to the direct elucidation of Horace is not very significant. A few acute hints in the interpretation of difficult places and a fair number of happy translations may still be considered of value. The larger part of his contribution is indirect, and consists in his open-minded literary dealing with Horace, and the confidential acquaintance he has made with him. From this comes the chief advantage of watching Horace through Coleridge's eyes. It develops literary vision.

**SOME POINTS OF GENERAL INTEREST
UPON THE HABITS OF THE
RATTLE-SNAKE.**

By A. H. PHILLIPS.

I have had under close observation during the past few months a rattle-snake,

which from appearances took more kindly to its unnatural surroundings of confinement than is the case with snakes of this class, it being generally considered that they refuse all food while in confinement, and in a fasting condition live from one to two years. This specimen fed as though in its natural environment.

The points to be noted are the following:

1st. That while the poisonous secretion may be used as a protection against its enemy, it also fulfills the no less important function of killing its prey. Every time a mouse was loosened in the box, the snake would assume the usual coiled position before striking and having given the stroke, would remain quiet. In no case did it strike a second time, however much the mouse leaped around in the convulsions that followed. Death resulted in one instance in 48 seconds, but in others it was much quicker. In all cases where the animal was small enough to be swallowed by the snake, death followed quickly enough to prevent its escape.

2d. In striking, the coiled position was almost always assumed, but did not seem necessary. It increases the field of command, as a wound can be inflicted at a greater distance and with greater accuracy. The distance at which a wound can be given while in this position, is roughly estimated at about two-thirds the entire length of the snake. The last, or tail coil, does not unwind while in the act of striking.

3d. The wound is inflicted, not by a pinching process of the jaws, but rather by a thrust, the upper and lower jaws being opened so wide as to be nearly in a straight line at the moment the wound is inflicted. The fangs, pointing forward at a right angle, are by the momentum of the body plunged into the tissues as a lance.

4th. In no instance, where small animals or birds not too large for food were introduced, was the warning rattle produced, the victim being struck quietly. Only in cases where it seemed the snake feared injury to itself was the warning sound given, indicating an unwillingness to bite. It would rather warn the offender than be

forced to strike through protection to itself. A dog seemed to excite it greatly. In such cases added to the rattle was a low hissing noise due to expulsion of air from the lungs, the body at the same time appearing greatly swollen from their inflated condition.

REVIEWS OF BOOKS.

OUR MORAL NATURE. Being a Brief System of Ethics. By James McCosh, D.D., LL.D., D.C.L., ex-President of Princeton College. New York, Charles Scribner's Sons, 1892.

This little volume of fifty-three pages from the pen of the veteran author is divided into three sections. Part First treats of Fundamental Principles, the topics being, Moral Obligation, Conscience, Moral Law, Love, The Divine Existence, The Combined Moral Principles, The Will, Evangelical Ethics, Sin and Punishment. These topics are very briefly but simply treated. The fundamental fact of Morality is the Consciousness of Obligation which expresses itself in moral law. The source of moral ideas is the Conscience which is both a cognitive and motive power. McCosh maintains here as elsewhere in his works, that moral quality is intrinsic in actions and that conscience perceives this quality and gives direct knowledge of rightness and wrongness. This is the objective side. Subjectively the root of good and evil is to be found in the will. Kant's doctrine that "nothing can possibly be conceived in the world or even out of the world, that can be called good without qualification, except a good will," is quoted with approval. The choice of will is necessary to make an action ours and to fix our responsibility for it. Our duties arise out of our relations. This suggests

the relation of morality to religion. The question of God's existence is briefly discussed. God's relation to morality is that of the Author of man's nature and of the moral law. From the standpoint of religion the obligations of morality become Divine Commands. Thus we are able to reconcile the two propositions, that morality is intrinsic and that it is a Divine Command. Evangelical Ethics is an extension of Natural Ethics. It arises in view of sin and the Scriptural doctrine of the Fall and the Christian scheme of Atonement and Redemption. Evangelical Ethics does not set aside Natural Ethics, but rather supplements and completes it.

Part Second treats of Moral Ideas. The principal topics here are Happiness and Morality, Moral Excellence, Justice, Rights, Property, Benevolence and Justice, Summum Bonum, Virtuous Acts, Morality and Our Natural Faculties. It is our duty to promote both happiness and virtue, but when conflict arises happiness must yield to the requirements of duty. Then follow sagacious observations on Justice, Rights and Property. The claims of Benevolence and Justice are treated in much the same spirit as those of happiness and morality. Both are obligatory, but in cases of conflict Justice must be given precedence. The Summum Bonum is not happiness, but moral excellence, although happiness is a bonum that all may seek to obtain. Moral

acts are voluntary and their motive should embrace both Love and Law. The author pleads for a conception of motive which shall include all the elements of man's nature,—sensitive, intellectual and emotive. Law must be supreme, but love must enter to give spontaneity to the performance of duty.

Part Third treats of Duties. Taking the Scriptural injunction to live soberly, righteously and godly, as the basis of classification, the author discusses Duties to God, False Systems, Duties to Our Fallen Men, to the Churches, the State, War, Duties to Ourselves, all of which are treated with good sense and discrimination. Dr. McCosh's book does not aim to be an elaborate treatise. It is rather a summary of the author's matured opinions on fundamental moral questions, the majority of which have been treated more at large in other works. In its form the treatise is simple and unpretentious, while in its content it is the product of ripe experience combined with philosophic wisdom and the spirit of true piety.

A. T. ORMOND.

VICTOR HUGO's "LA CHUTE," by H. C. O. HUSS, Ph.D., Professor of Modern Languages and Literature in the College of New Jersey, Princeton. D. C. Heath & Co., 1892.

Professor Huss presents to teachers of French an extract of eighty-two pages from Part Second, Book First, of "Les Misérables." The selection was evidently made after a careful consideration of the needs of schools and colleges, and one might say, a reverent estimate of the great literary monument from which it was detached. We fancy that few editors would have been so scrupulous not to misrepresent a master of whose work they designed to present only a short specimen. Victor Hugo the philanthropist, Victor Hugo the

psychologist,—his autograph is written as large across these few but burning pages as in the fifty octavo volumes of the *Édition définitive*.

"La Chute" embraces the mysterious appearance of the escaped convict Jean Valjean in the town of Digne, his hospitable reception by Bishop Myriel, after being driven from the doors of others, his moral fall and recovery.

We have always thought Victor Hugo good reading for students, both because of his paramount importance among modern Frenchmen and because of the brilliant simplicity of his style and the intensity of his thought; but the enormous length of "Les Misérables" and even the great length of "Notre-Dame de Paris" and "Quatre-vingt-treize," seemed to bar out his prose from the class-room. "Thrice happy then the author!" it would be easy to exclaim at this point. But we think Hugo himself, lover and understander of the young, would join us in recognizing that even the ill-founded enthusiasm of a boy, stumbling through an author he but half understands, yet feels and adores, is more to be coveted by a man of letters than the cold appreciation of an adult, who understands, but is little influenced.

What the youth who reads Hugo cannot help feeling in every fibre of his being, whether he knows his irregular verbs or not, is the spurt of emotion that bursts from the great heart of the author, proving life real and affirmative, and making self-evident the one truth which poets never cease to sing, the truth that love is best. A boy of sixteen who reads "La Chute," and through it gains sympathetic knowledge of Hugo, will have profited more than if he were to wait ten years and then to read the whole of "Les Misérables." It is a fine thing to have obtained early an insight into the mind of a great man.

Books which mediate such intimacy are the best educators.

GEO. M. HARPER.

THE NICENE AND POST-NICENE FATHERS. Second Series. Vol. III. Theodoret, Jerome, Gennadius, Rufinus: Historical Writings, etc. New York: The Christian Literature Co. 1892.

The second part of this volume, pp. 349-402, is Jerome and Gennadius. Lives of Illustrious Men. Translated, with Introduction and Notes, by Ernest Cushing Richardson, Ph.D., Librarian of Princeton College. In his Introduction Dr. Richardson treats of the time and place of composition and of the character of the dual work, of the literature on the two authors as well as on these whose biographies they write, of the various manuscripts,

editions and translations of the Lives, and of the present translations. The work of Jerome is settled as having been written at Bethlehem in 492, and that of Gennadius almost certainly about 400, the earliest of the dates usually given. The so-called Lives are mere paragraphs, whose purpose was to enumerate the various treatises written by the authors named. Dr. Richardson has seen 84 MSS. of Jerome and 57 of Gennadius and has memoranda of at least 25 more and hints of still another score. His translation is made from the text of Herding, with corrections in instances in which the evidence of the MSS. was clearly against that text. He was unable to do what he had at first intended, viz.: publish a corrected text of the two works. The value of the translation is instanced by numerous critical and explanatory notes. J. H. DULLES.

NOTES.

PROFESSOR JOHN DE WITT, D.D.

The new Professor of Church History in the Theological Seminary at Princeton, was born at Harrisburgh, Pa., October 10th, 1842. He graduated from Princeton College in 1861 and at once began the study of law; but soon discontinued this and entered Princeton Seminary the same year. After spending a little more than two years at Princeton he completed his theological course in Union Seminary, New York. Dr. DeWitt served pastorates at Irvington, N. Y., Boston, Mass., Pittsburgh and Philadelphia, Pa. In 1882 he became Professor of Ecclesiastical History and Church Polity in Lane Theological Seminary, Cincinnati, Ohio. This chair he exchanged in 1888 for that of Apologetics and Missions in McCormick Theological Seminary, Chicago, Ill. There he remained until called to the chair he now occupies in

Princeton. He was a director of the Seminary from 1881 until 1883. He published in 1885 "Sermons on the Christian Life."

The Rev. J. H. Dulles, Librarian of the Theological Seminary, has published a list of *One Hundred Books for the Minister's Library*. As stated in a prefatory note, the chief purpose of this list is to meet the minister as a student of the Bible. Although primarily intended for Presbyterian ministers, it is denominational only in a few instances. It embraces works under the following heads: General; Exegesis—*Introductory*; Exegesis—*Commentaries*; Apologetics; Dogmatics; Ethics and Ecclesiastics, and History.

Mr. M. Fischer, the Curator of the E. M. Museum, has published in the *American*

Naturalist for May, 1892, the following translation from the French: Rules of Nomenclature adopted by the International Zoological Congress held in Paris, France, 1889.

In the *Neues Jahrbuch für Mineralogie*,

Geologie und Paläontologie, Jahrgang 1892, erster Band, a translation of a paper by Dr. Charles E. Beecher from the *American Journal of Science*, Vol. XLI, April, 1891, entitled "Development of the Brachiopoda." Part I. Introduction.

Charles Scribner's Sons New Books.

MARSE CHAN. *New Illustrated Edition.*

By THOMAS NELSON PAGE. Illustrated by W. T. SMEDLEY. Square 12mo, \$1.50.

"A new edition of this exquisite little masterpiece, choicely printed and illustrated with capital drawings. It is one of the dialect stories that will live"—*Philadelphia Times*.

"Brought out in superb holiday form. Mr. Smedley has caught precisely the spirit of the text. The delicacy and truthfulness of his touch have been well brought out."—*Boston Beacon*.

CHILDREN OF THE POOR.

By JACOB A. RIIS. Illustrated. Square 12mo, \$2.50

A companion and supplement to Mr. Riis's well-known "How the Other Half Lives," and, like that work, it is a systematic study which embodies the results of close personal observations of the social conditions of the poor. It is illustrated from photographs by the author.

SPANISH CITIES.

With Glimpses of Gibraltar and Tangier. By C. A. STODDARD, D.D. Illustrated. 12mo, \$1.50.

"He has mastered the art of writing books of travel. He fulfills the ideal of a delightful companion whose conversation has informing qualities without being tedious, and whose style has sparkle without froth"—*N. Y. Tribune*.

LIFE AND LETTERS OF WASHINGTON ALLSTON.

By JARED B. FLAGG, N. A., S. T. D. With 18 reproductions of Allston's paintings. Large 8vo, \$5.00.

A poet and novelist as well as a great painter, and the friend of the most eminent men of his time, Allston was, in character, temperament and genius, one of the most interesting figures of his day; and this, the first full and authentic story of his life, is both important as a biography and fascinating as a narrative.

LIFE OF MICHEL ANGELO.

By JOHN ADDINGTON SYMONDS. With appendices and 50 handsome illustrations. Large 8vo, 2 vols., \$12.50.

Mr. Symonds is recognized as the highest authority on the Renaissance, and his new book is the ripest fruit of prolonged study. It will take high rank in biographical literature as a portrait of the man and as a picture of his times.

AFLOAT AND ASHORE ON

THE MEDITERRANEAN.

By LEE MERIWETHER. Illustrated. 12mo, \$1.50.

An unconventional journey, full of novel and out-of-the-way episodes and humorous incidents. The illustrations from the author's kodak are a feature of the book.

CYCLOPEDIA OF PAINTERS AND PAINTINGS.

Edited by J. G. CHAMPLIN, JR. Critical Editor, C. C. PERKINS. *Popular Edition.* 2000 illustrations. 4to, 4 vols., \$20.00 net.

"The publication of this monumental work leaves far behind it all similar enterprises. Here is a reference-book of the highest order, a work upon which the country is to be congratulated, for no nation has produced anything superior to this."—*Boston Beacon*.

NEW SAINT AMAND VOLUMES.

The Duchess of Berry and the Court of Louis XVIII.
The Duchess of Berry and the Court of Charles X
The Duchess of Berry and the Revolution of 1830.

3 vols. Each with Portrait. 12mo, \$1.25.

"The life of the Duchess of Berry shows a fascinating woman whose history is full of interest, and it is written in the delightful style of vivid and graceful narration that characterizes the earlier volumes in this series."—*N. Y. Observer*.

DR. J. G. HOLLAND'S TWO POEMS,

BITTERSWEET and KATHRINA.

Cameo Edition. Each with an etched frontispiece. 16mo, gilt top, \$1.25.

In this series there have already appeared Mr. Mitchell's "Reveries of a Bachelor" and "Dream Life," Mr. Cable's "Old Creole Days," and Mr. Page's "In Old Virginia."

"Dainty little volumes that are a model of the bookmaker's art."—*Philadelphia Press*.

THE GREAT STREETS OF THE WORLD. 8vo, fully illustrated, \$4.00.

BROADWAY. By RICHARD HARDING DAVIS—PICCADILLY. By ANDREW LANG.—THE BOULEVARDS. By FRANCISQUE SARCEY.—UNTER DEN LINDEN. By PAUL LINDAU.—THE CORSO OF ROME. By W. W. STORY.—THE GRAND CANAL. By HENRY JAMES.—THE NEVSKY PROSPEKT. By ISABEL F. HAPGOOD.

This series of pictures of the characteristic life of the great streets of the world's most famous cities is international in its scope, and is varied and brilliant in color. The illustrations are numerous and handsome, and represent the best work of eminent artists and engravers.

CHARLES SCRIBNER'S SONS, 743-745 Broadway, N. Y.

When you write please mention PRINCETON COLLEGE BULLETIN.

Standard Classical Texts

Harper and Miller's Vergil's Aeneid.

By WILLIAM R. HARPER, Ph.D., and
FRANK J. MILLER, Ph.D. 12mo, cloth.

Price, \$1.25

Special attention is called to the unusually copious material for the study of the bibliography, life, and critical analysis of the poet, together with the varied and rich notes. These, placed on the page with the text, illustrate most fully the meaning of the text and bring into clear light its artistic and literary value—a feature unknown to previous editions.

Harper and Tolman's Cæsar. By WM.

R. HARPER, Ph.D., and HERBERT C. TOLMAN, Ph.D. Cloth, 12mo. 502 pages, 60 illustrations, 9 colored maps. Price, 1.20

"The outfit for Cæsar, in Introduction, Classified Lists, Vocabulary, Maps and various illustrations, is a very complete and beautiful one, and altogether the best book in everything the teacher and pupil can wish for."—WM. A. PACKARD, Ph.D., Professor of Latin, Princeton College, Princeton, N. J.

These form part of Dr. Harper's Inductive Classical Series, which now includes:

Harper & Burgess's Inductive Latin

Method 1.00

Harper & Burgess's Inductive Latin

Primer 1.00

Harper & Waters's Inductive Greek

Method 1.00

In Preparation

Harper & Wallace's Zenophon's Anabasis

Harper & Castle's Inductive Greek Primer

Harper & Castle's Greek Prose Composition

Harper & Stewart's Cicero

Harkness's Standard Latin Grammar 1.12

Harkness's Sallust's Catiline, with Notes and Vocabulary 90

Arnold's Latin Prose Composition 87

Lindsay's Satires of Juvenal 1.00

Hadley & Allen's Greek Grammar 1.50

Books sent prepaid on receipt of price. Circulars and Descriptive List Sections Free. Correspondence cordially invited.

AMERICAN BOOK COMPANY

New York

Cincinnati

Chicago

Boston

Atlanta

G. E. STECHERT, 810 Broadway, New York.

German:

HUTH, Dr. GEORG, Geschichte des Buddhismus in der Mongolei, aus dem Tibetischen des Jigs-med nam-mk'a herausgegeben und erläutert. 1. Theil. gr.8.

GOTTSCHALL, RUD. von. Studien zur neuen deutschen Literatur bound. gr.8.

HERTZ, Dr. HEINR. Untersuchungen ueber die Ausbreitung der electrischen Kraft. Mit 40 Figuren im Text. gr.8.

FRANK, Dr. A. B. Lehrbuch der Botanik nach dem gegenwärtigen Stand der Wissenschaft. I. Band Zellenlehre Anatomie und Physiologie. Illustr. 8.

RUDIO, Dr. F. Archimedes Huygens, Lambert, Legendre. 4 Abhandlungen über die Kreismessung. Deutsch herausgegeben und mit einer Uebersicht ueber die Geschichte des Problems von der Quadratur des Zirkels. Mit Figuren im Text. 80.

LEHMANN, ALFR. Die Hauptgesetze des menschlichen Gefühlslebens. Eine experimentelle und analytische Untersuchung ueber die Natur und das Auftreten der Gefühlszustände. Von der kgl. dänischen Akademie preisgekröntes Werk. Uebersetzt v. F. Bendixen. 8.

KITTLER, Dr. ERASM. Handbuch der Elektrotechnik. 2 Auflage Band I., II. gr. 8.

KLEIN, FEL. Vorlesungen ueber die Theorie der elliptischen Modulfunctionen ausgearbeitet und vervollständigt von Dr. Rob. Fricke. Band II. gr. 8.

Grundriss der theologischen Wissenschaften bearbeitet von Achelis, Cornill, Harnack, Holtzmann u. A. 2te Abtheilung. Müller D. K. Kirchengeschichte. Band I. gr. 8^o.

KELLE, JOH. Geschichte der deutschen Litteratur von der ältesten Zeit bis zur Mitte des elften Jahrhunderts. 8.

GWINNER, WILH. Goethe's Faustidee nach der ursprünglichen Conception aufgedeckt und nachgewiesen. 8.

CORNILL, CARL HEINRICH. Einleitung in das Alte Testament. Cloth. 8

WENDLAND, PAUL. Philos. Schrift ueber die Vorsehung. Ein Beitrag zur Geschichte der nacharistotelischen Philosophie. gr. 8.

WERDER, KARL. Vorlesungen ueber Lessings Nathan, gehalten an der Universität zu Berlin (zuerst im Winter 1862, wiederholt 1864 und spaeter). 8.

FALCKENBERG, PROF. Dr. RICHARD. Geschichte der neueren Philosophie von Nikolaus von Kues bis zur Gegenwart. Im Grundriss dargestellt. Zweite verbesserte und vermehrte Auflage. gr. 8.

Handkommentar zum Alten Testament. In Verbindung mit anderen Fachgelehrten herausgegeben von Prof. D. W. Nowack. III. Abtheilung. Die prophetischen Bücher. Erster Band. Das Buch Jesaja uebersetzt und erklärt von Prof. Dr. Bernh. Duhn. gr. 8.

✂ I have just established a branch at Paris—35 Rue Bonaparte—and beg to offer my services for quick importations at reasonable prices.

G. E. STECHERT, 810 Broadway, New York.

B. WESTERMANN & CO.,

(ESTABLISHED 1848)

BOOKSELLERS AND IMPORTERS,

812 BROADWAY, NEW YORK.

JUST PUBLISHED:

BRUGMANN. Comparative Grammar of the Indo-Germanic Languages. Vol. III., cloth, \$3.25 *net*. [Vols. I. and II., cloth, \$9.40 *net*.] The fourth and concluding volume of this, the most important contribution to comparative philology since Bopp's Grammar, with full index, will appear next year.

DIEHL, CHARLES. Excursions in Greece to the Recently Explored Sites of Classical Interest. 1 vol., crown 8vo., cloth, \$2.00. A popular account of recent excavations, illustrated.

HUTTON. Old Sword-Play. The Systems of Fence in vogue during the 16th, 17th

and 18th centuries. With 57 plates and portrait. Limited edition of 100 copies for America, large 8vo. cloth, \$6.00 *net*.

ENGELMANN-ANDERSON. Pictorial Atlas to Homer's Iliad and Odyssey. Illustrated, folio, cloth, \$3.00.

FLUGEL'S Great Dictionary. German-English, 1 vol. English-German, 2 vols. Three stout 4to volumes, full sheep, \$16.50; half morocco, \$18.00.

BARON OMPTEDA'S MEMOIRS: A Hanoverian-English Officer a Hundred Years Ago. Translated by John Hill. With portrait. 8vo, cloth, \$5.00.

ESTABLISHED 1818.

BROOKS BROTHERS,

Broadway, cor. 22d Street, New York City.

Clothing and Furnishing Goods

FOR MEN AND BOYS,

READY MADE AND MADE TO MEASURE.

FOR FALL AND WINTER OF 1892-93.

The shape, style and finish of our Ready-made garments for Men, Boys and Children continue, we believe, to show improvement, and at prices that will compare favorably with articles much inferior in material and workmanship.

Our Furnishing Department contains Gloves of the proper shades and trim for different occasions. Many rich novelties in Neckwear, current in London the present season, together with silk squares in confined designs for Scarfs, to order. Hand-knit Scotch long Hose in striking patterns. Bright silk half Hose. Allen, Solly & Co.'s Underwear, etc. Lincoln, Bennett & Co.'s Hats for Boys and Children.

Samples and rules for self-measurement will be sent on application. Our location, one block from Madison Square, is convenient to the leading hotels and easy of access from the principal railway stations in New York and vicinity.

G. SCHIRMER,

PUBLISHER * AND * IMPORTER * OF

* MUSIC *

SOLE AGENT IN THE UNITED STATES FOR

"Edition Augener," (London) and "Edition Peters" (Leipzig.)

35 UNION SQUARE, NEW YORK.

—: o :—

RECENT PUBLICATIONS.

HEINTZ, ALBERT.

"*The Master-singers of Nuremberg*," by Richard Wagner. Attempt at a Musical Explanation, with 84 Examples in Notes accompanying the Text. Translated from the second German Edition by J. H. Cornell. Flex. cloth, net, 1.00

KLAUWELL, DR. OTTO.

On Musical Execution. An Attempt at a systematic Exposition of the same, primarily with Reference to piano-playing. Translated by Dr. Th. Baker. Flex. cloth, net, 75

KOBBÉ, GUSTAV.

Richard Wagner's Life and Works. 2 Volumes. Bound in cloth, each, . . net, 1.50
Vol. I. Contents: Biography, Bayreuth Echoes, Wagner's Writings, Wagner's Critics, Wagner's Operas, Index to Biography, and with 11 Illustrations.

Vol. II. Contents: Introduction, The Rhinegold, The Valkyr, Siegfried, The Dusk of the Gods, Tristan and Isolde, The Master-singers of Nuremberg, Parsifal, and with 8 Illustrations.

WOLZOGEN, HANS von.

Guide through the Music of Richard Wagner's "*The Ring of the Nibelung*." A new Edition, translated by Nathan Haskell Dole, net, 50

Guide through the Musical Motives of Richard Wagner's "*Tristan and Isolde*." With a Preface on the Legend and the Poem of Wagner's Drama, net, 50

Guide through the Music of Richard Wagner's "*Parsifal*." A new Edition, translated by J. H. Cornell.

—: o :—

Mail Orders receive prompt and careful attention.

THE
Equitable
 LIFE ASSURANCE
 SOCIETY

OF THE UNITED STATES.

JANUARY 1, 1892.

ASSETS,	\$136,198,518
Liabilities,	109,905,537
SURPLUS,	\$26,292,981
INCOME,	\$39,054 944
New Business }	
written in 1891, }	233,118,331
Assurance }	
in force..... }	804,894,557

HENRY B. HYDE, President.

JAMES W. ALEXANDER, Vice-Pres't.

For particulars apply to

HENRY HALE,
 MANAGER METROPOLITAN DISTRICT,
 120 BROADWAY,
 NEW YORK.



Spencer Trask & Co., Bankers,

NOS. 16 & 18 BROAD STREET, NEW YORK CITY.

ALBANY, N. Y.: State St., cor. James. SARATOGA: Grand Union Hotel. PROVIDENCE, R. I.: 5 & 7 Exchange St

Transact a General Banking Business.

All Classes of Securities Bought and Sold on Commission, and Carried on Margins.

INTEREST ALLOWED ON DAILY BALANCES. DEPOSITS RECEIVED SUBJECT TO SIGHT CHECKS

DIRECT WIRE TO EACH OFFICE, AND TO

PHILADELPHIA :
32 South Third Street.

BOSTON :
20 Congress Street, 63 Federal Street, 60 State Street,

CHICAGO :
Board of Trade

MARQUAND & PARMLY, BANKERS,

AND DEALERS IN

SECURITIES FOR INVESTMENT.

160 BROADWAY,

NEW YORK.

Lawrenceville School

JOHN C. GREEN FOUNDATION.

Capacity of Institution enlarged to receive 300 pupils during the ensuing academic year.

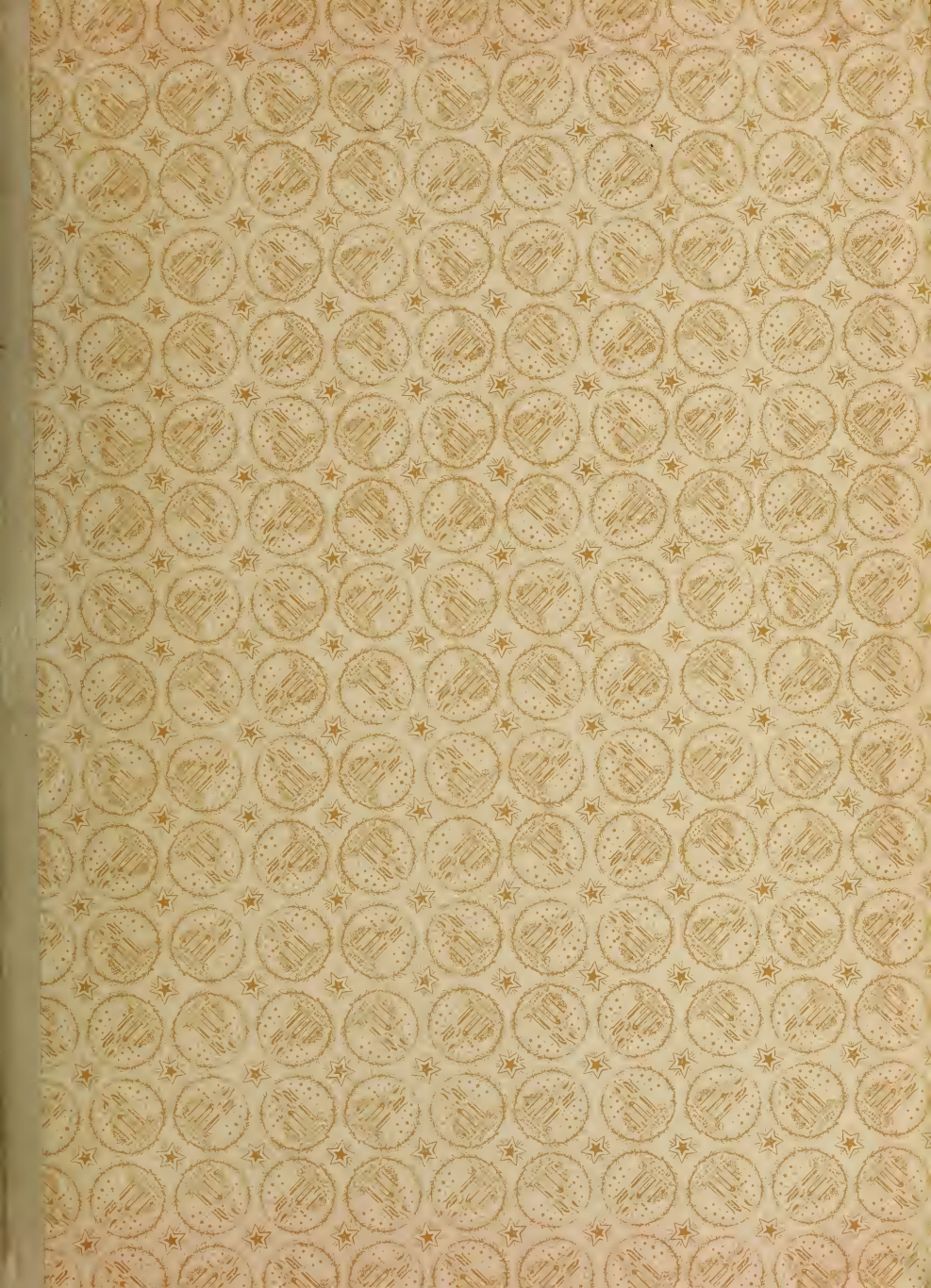
Boys should be at least thirteen years of age and be prepared to pass a satisfactory examination upon elementary English studies.

Terms from \$400 to \$700.

There is a limited number of scholarships of the annual value of from \$100 to \$300.

For catalogue and information address the Head Master.





UNIVERSITY OF ILLINOIS-URBANA



3 0112 086068514